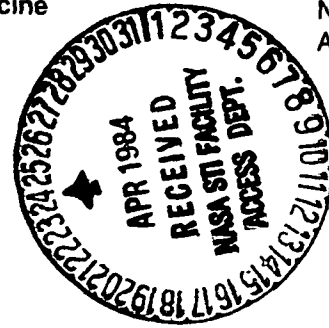




Aerospace Medicine  
and Biology  
A Continuing  
Bibliography  
with Indexes

NASA SP-7011(257)  
April 1984



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# **AEROSPACE MEDICINE AND BIOLOGY**

## **A CONTINUING BIBLIOGRAPHY WITH INDEXES**

**(Supplement 257)**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in March 1984 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch

1984

**National Aeronautics and Space Administration**

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# INTRODUCTION

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In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Six indexes -- subject, personal author, corporate source, contract, report number, and accession number -- are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1984 Supplements.

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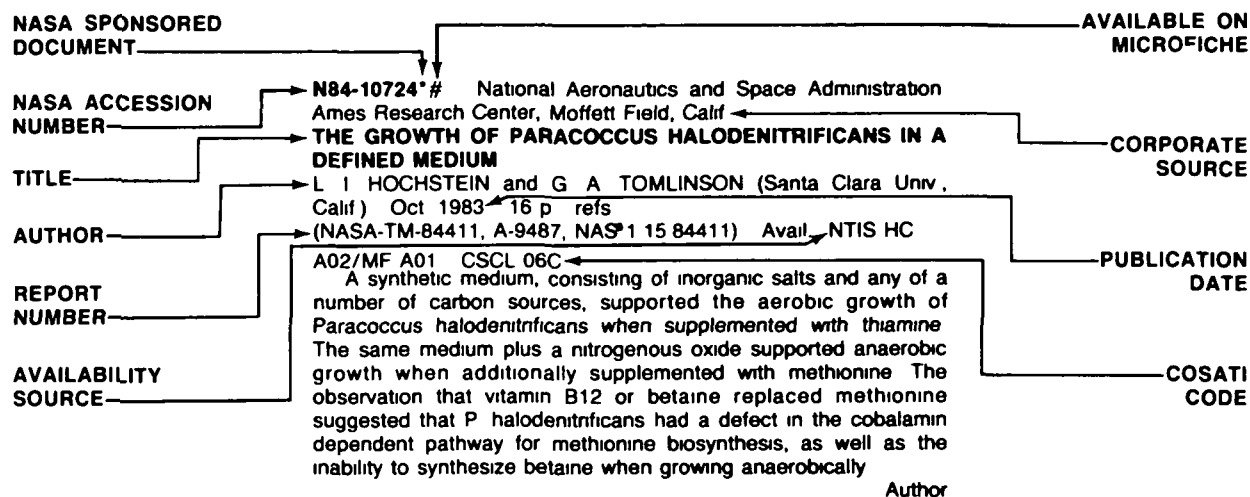
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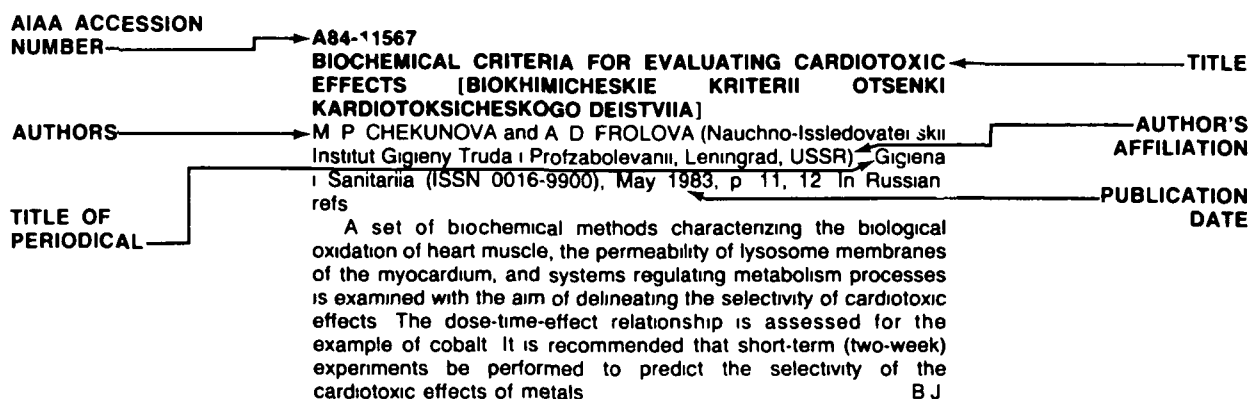
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# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 257)*

APRIL 1984

51

## LIFE SCIENCES (GENERAL)

Includes genetics.

### A84-15925

#### THE USE OF TOXINS IN THE CHARACTERIZATION OF THE Na(+) CHANNEL IN CARDIAC MUSCLE

S E FREEMAN, P J GRAY, A M. KEEGHAN, and M P BLADEN  
(Defence Science and Technology Organization, Materials Research Laboratories, Ascot Vale, Victoria, Australia) *Toxicon*, Supplement (ISSN 0041-0107), no 3, 1983, p 153-156

The Na(+) channel in guinea-pig atrial muscle is investigated, evaluating the effects of various toxins on the ability of 50-mM trimethyloxonium tetrafluoroborate (TMO) to block the current flow (as determined from action potentials derived by electronic differentiation from microelectrode measurements) The results are presented in a table and graph for tetrodotoxin (TTX, 5 microM), edrophonium (Ed, 50 microM), atropine (200 nM), quinuclidinyl benzilate (200 nM), neostigmine (1 microM), and Ed in combination with post-TMO TTX The preparation was protected from the TMO effect by TTX or Ed but only partially by the other toxins It is inferred that the carboxyl groups critical to action-potential propagation are protected by TTX or Ed, and that the Na(+) channel is collocated with the muscarinic receptor and/or AChE.

T K

### A84-15954\*

State Univ of New York, Stony Brook  
**ON THE EVOLUTIONARY CONSTRAINT SURFACE OF HYDRA**  
L B SLOBODKIN and K DUNN (New York, State University, Stony Brook, NY) *Biological Bulletin* (ISSN 0006-3185), vol 165, Aug 1983, p 305-320 Research supported by the Mobil Oil Foundation, Consiglio Nazionale delle Ricerche, and NASA refs

Food consumption, body size, and budding rate were measured simultaneously in isolated individual hydra of six strains For each individual hydra the three measurements define a point in the three dimensional space with axes food consumption, budding rate, and body size These points lie on a single surface, regardless of species Floating rate and incidence of sexuality map onto this surface It is suggested that this surface is an example of a general class of evolutionary constraint surfaces derived from the conjunction of evolutionary theory and the theory of ecological resource budgets These constraint surfaces correspond to microevolutionary domains

Author

### A84-16044

#### MEMBRANE LIPID FROM DEEP-SEA HYDROTHERMAL VENT METHANOGEN - A NEW MACROCYCLIC GLYCEROL DIETHER

P B COMITA and R B GAGOSIAN (Woods Hole Oceanographic Institution, Woods Hole, MA) *Science* (ISSN 0036-8075), vol 222, Dec 23, 1983, p 1329-1331 refs  
(Contract NIH-RR-00317, NSF OCE-80-24256)

The membrane lipid of a new deep-sea hydrothermal vent methanogen, *Methanococcus jannaschii*, has been structurally characterized The hydrolyzed polar lipid of this archaeobacterium is primarily (95 percent) a macrocyclic glycerol diether, which has

not been described previously The structure was elucidated by a combination of chemical and spectroscopic techniques An initial survey of selected methanogens failed to indicate the presence of this membrane lipid in any microorganism other than *Methanococcus jannaschii*

Author

### A84-16176

#### EFFECT OF ACUTE EXERCISE AND PROLONGED TRAINING ON INSULIN RESPONSE TO INTRAVENOUS GLUCOSE IN VIVO IN RAT

D E JAMES, K M BURLEIGH, E W KRAEGEN, and D J CHISHOLM (St Vincent's Hospital, Sydney, Australia) *Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology* (ISSN 0161-7567), vol 55, Dec 1983, p 1660-1664 Research supported by the National Health and Medical Research Council of Australia refs

### A84-16181

#### ASSESSMENT OF RECOVERY FROM HYPERBARIC-INDUCED SUBFERTILITY IN MALE MICE

C J DORE, M J HALSEY, S MONK, and B WARDLEY-SMITH (Clinical Research Centre, Harrow, Middx, England) *Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology* (ISSN 0161-7567), vol 55, Dec 1983, p 1709-1712 refs

### A84-16182

#### CRITICAL O<sub>2</sub> TRANSPORT VALUES AT LOWERED BODY TEMPERATURES IN RATS

S M CAIN and W E BRADLEY (Alabama, University, Birmingham, AL) *Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology* (ISSN 0161-7567), vol 55, Dec 1983, p 1713-1717 refs  
(Contract NIH-HL-26927)

Young male rats were exposed to 34 C temperatures and increased ventilation to determine if arterial uptake of O<sub>2</sub> increased in either normoxic, hyperoxic, or hypoxic conditions during mild hypothermia and increased blood flow rates The heart rates, arterial pressure, rectal temperature, and blood O<sub>2</sub> sample concentrations were monitored Rectal temperatures of 34, 36, and 38 C were studied Insertion of a tracheal tube into the right ventricle permitted controlling the O<sub>2</sub> input. The O<sub>2</sub> uptake was significantly less in the rats at 34 C, and increasing the O<sub>2</sub> transport through the catheter did not alter the situation The data suggested that O<sub>2</sub> transfer to the tissues is reduced in amounts corresponding to the reduction in O<sub>2</sub> requirements in hypoxic conditions

M S K

### A84-16183

#### VENTILATION AND CSF IONS DURING HYPOCAPNIC HCL AND HNO<sub>3</sub> ACIDOSIS IN CONSCIOUS RABBITS

E E NATTIE and G F BIRCHARD (Dartmouth College, Hanover, NH) *Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology* (ISSN 0161-7567), vol 55, Dec 1983, p 1748-1757 refs

(Contract NIH-HL-28066)



## 51 LIFE SCIENCES (GENERAL)

**A84-16184**

### **VENTILATION AND CSF IONS DURING ISOCAPNIC HCL AND HNO<sub>3</sub> ACIDOSIS IN CONSCIOUS RABBITS**

E E NATTIE and R REEDER (Dartmouth College, Dartmouth-Hitchcock Medical Center, Hanover, NH) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1758-1766 refs

(Contract NIH-HL-28066)

**A84-16188**

### **INTERACTION BETWEEN NOREPINEPHRINE AND HYPOXIA ON CAROTID BODY CHEMORECEPTION IN RABBITS**

W. K. MILSOM (British Columbia, University, Vancouver, Canada) and T. SADIQ (Bristol, University, Bristol, England) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1893-1898 Research supported by the Natural Sciences and Engineering Research Council of Canada refs

(Contract NIH-HD-09457)

**A84-16189**

### **INFLUENCE OF HEAT STRESS ON EXERCISE-INDUCED CHANGES IN REGIONAL BLOOD FLOW IN SHEEP**

A. W. BELL, J. R. S. HALES, R. B. KING, and A. A. FAWCETT (Commonwealth Scientific and Industrial Research Organization, Ian Clunies Ross Animal Research Laboratory, Prospect, New South Wales, Australia) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1916-1923 refs

**A84-16663\*** Wright State Univ., Dayton, Ohio

### **AN EXERCISE METABOLISM CHAMBER FOR MICE**

R. M. GLASER (Wright State University, Dayton, OH) and H. S. WEISS (Ohio State University, Columbus, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p. 1184-1189 refs

(Contract NGR-36-008-004)

**A84-16725\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif

### **THE EFFECTS OF REDUCED OXYGEN AND OF CARBON MONOXIDE ON PERFORMANCE IN A MOUSE POLE-JUMP APPARATUS**

D. E. CAGLIOSTRO and A. ISLAS (NASA, Ames Research Center, Moffett Field, CA) Journal of Combustion Toxicology (ISSN 0362-1669), vol 9, Nov 1982, p. 187-193 refs

The effects on reaction time and behavior were studied for exposure to reduced oxygen concentrations in the presence and absence of carbon monoxide. Tests were run with Swiss Webster mice in a pole-jump apparatus. The results show that reaction times increase gradually with a decrease in oxygen (O<sub>2</sub>) to 10 percent O<sub>2</sub>. Below 10 percent O<sub>2</sub> reaction times increase dramatically and performance is degraded almost immediately. At carbon monoxide (CO) concentrations of 500 ppm and reduced O<sub>2</sub> levels, reaction times are increased even more. At CO concentrations of 1000 ppm, performance is nearly completely degraded even without reduced oxygen levels. Author

**A84-16933**

### **RETARDED FLUORESCENCE OF PIGMENT-PROTEIN COMPLEXES OF PHOTOSYSTEM I, BUILT INTO THE LIPOSOMES [O ZAMEDLENNOI FLUORESTSENTSII PIGMENT-BELKOVYKH KOMPLEKSOV FOTOSISTEMY I, VSTROENNYKH V LIPOSOMY]**

G. SH. VASHAKMAZDE, I. R. VASILEV, G. P. KUKARSKIKH, D. N. MATORIN, T. E. KRENDELEVA, and A. B. RUBIN (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol 268, no 3, 1983, p. 723-726 In Russian refs

**A84-16934**

### **EXCESS SYNTHESIS OF DNA IN HELA CELLS AFTER GAMMA-IRRADIATION AND TREATMENT WITH N-METHYL-N'-NITRO-N-NITROZOGUANIDINE [IZBYTOCHNYI SINTEZ DNK V KLETKAKH HE LA POSLE GAMMA-OBLUCHENIIA I OBRABOTKI N-METIL-N'-NITRO-N-NITROZOGUANIDINEM]**

G. B. BELOSTOTSKAIA and O. V. MALINOVSKI (Akademiia Nauk SSSR, Leningradskii Institut Iadernoi Fiziki, Gatchina, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol 268, no 3, 1983, p. 739-742 In Russian refs

**A84-16967**

### **THE EFFECT OF IONIZING RADIATION ON THE METABOLISM OF BOUND SUGAR IN RABBIT AND RAT BLOOD [VLIANIE IONIZIRUIUSHCHEGO IZLUCHENIIA NA OBMEN SVIAZANNOGO SAKHARA V KROVI KROLIKOV I KRYIS]**

G. M. GUSEINOVA and M. M. NASIBOV (Azerbaidzhanskii Gosudarstvennyi Universitet, Baku, Azerbaidzhan SSR) Akademiia Nauk Azerbaidzhanskoi SSR, Doklady (ISSN 0002-3078), vol 39, no 5, 1983, p. 67-69 In Russian refs

**A84-17276**

### **ULTRASTRUCTURAL ASPECTS OF ACUTE ISCHEMIA OF THE BRAIN IN THE CASE OF THE ADMINISTRATION OF Nootropil (EXPERIMENTAL STUDY) [UL'TRASTRUKTURNYE ASPEKTY OSTROI ISHEMII GOLOVNOGO MOZGA V USLOVIIAKH PRIMENENIIA NOOTROPILA /EKSPERIMENTAL'NOE ISSLEDOVANIE/]**

N. N. BOGOLEPOV, E. I. GUSEV, G. S. BURD, and S. B. BUKLINA (II Moskovskii Gosudarstvennyi Meditsinskii Institut, Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR) Zhurnal Nevropatologii i Psikhiiatrii im. S. S. Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p. 984-990 In Russian refs

Electron microscopy of the sensorimotor cortex was investigated in 27 rats at different times (1, 3, or 7 days) after arterial carotid communis occlusion. Three groups of rats (five rats in each group) were treated with nootropil (500 mg/kg daily) in accordance with the three time intervals; control rats were undrugged. Brain neurons in rats treated with the drug were found to be better preserved than in untreated rats, and neuronal organelles in treated rats had fewer signs of irreversible damage. Membranes were better preserved in treated rats, and the fragmentation and vacuolization of organelles were less pronounced. It is suggested that the results are associated with the ability of nootropil to normalize the ATP metabolism, to stimulate phospholipid synthesis and the ribosome function, and to increase the utilization of glucose. The use of GABA derivatives in the case of acute brain ischemia is discussed. B.J.

**A84-17277**

### **MECHANISMS OF PATHOLOGICAL AND REPARATIVE PROCESSES IN BRAIN TISSUE CELLS IN THE POSTISCHEMIC PERIOD ACCORDING TO DATA OF ELECTRON-CYTOCHEMICAL ANALYSIS OF NUCLEAR CHROMATIN AND RIBONUCLEOPROTEINS [MEKHANIZMY PATOLOGICHESKIKH I VOSTANOVITEL'NYKH PROTSESSOV V KLETKAKH TKANI MOZGA V POSTISHICHESKOM PERIODE PO DANNYM ELEKTRONNO-TSITOKHIMICHESKOGO ANALIZA IADERNOGO KHROMATINA I RIBONUKLEOPROTEIDOV]**

V. V. SEMCHENKO and S. S. STEPANOV (Omskii Meditsinskii Institut, Omsk, USSR) Zhurnal Nevropatologii i Psikhiiatrii im. S. S. Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p. 980-984. In Russian refs

A84-17278

**ALLOTTRANSPLANT OF EMBRYONIC CEREBRAL TISSUE INTO THE BRAIN OF MATURE MAMMALS IN THE CASE OF HYPOXIC HYPOXIA [ALLOTTRANSPLANTATSIIA EMBRIONAL'NOI TKANI MOZGA V GOLOVNOI MOZG VZROSLYKH MLEKOPITAIUSHCHIKH PRI GIPOKSICHESKOI GIPOKSII]**  
L. V. POLEZHAEV and M. A. ALEKSANDROVA (Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR) Zhurnal Nevropatologii i Psikiatrii im. S. S. Korsakova (ISSN 0044-4588), vol. 83, no. 7, 1983, p. 990-997. In Russian. refs

A84-17282

**POSSIBILITY OF THE APPEARANCE OF CELLULAR STRUCTURES ON THE SURFACE OF THE VASCULAR PLEXUS, REVEALED BY SCANNING ELECTRON MICROSCOPY [VOZMOZHNOSTI VOZNIKNOVENIIA KLETOCHNYKH STRUKTUR NA POVERKHNOSTI SOSUDISTOGO SPLETENIIA, VYIAVLIAEMYE SKANIRUIUSHCHEI ELEKTRONNOI MIKROSKOPIEI]**

A. I. KIKTENKO (Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR) Zhurnal Nevropatologii i Psikiatrii im. S. S. Korsakova (ISSN 0044-4588), vol. 83, no. 7, 1983, p. 967-971. In Russian. refs

Scanning electron microscopy was used to investigate the possible ways in which macrophages appear on the epithelial surface of the cerebral vascular plexus in rats. Results support the theory that macrophages are formed in the blood flow or the connective tissue and that they subsequently penetrate through the epithelium of the vascular plexus onto its surface which is in contact with cerebrospinal fluid. The structural stages of the process are reflected in the present results. B. J.

A84-17290

**THE PRESENT STATE OF CHRONOMEDICINE [KHROMEDITSINA NA SOVREMENNOM ETAPE]**

F. I. KOMAROV (Sovetskaya Meditsina, no. 6, 1983, p. 3-8. In Russian. refs

Current research on biological (particularly circadian) rhythms and on chronobiology and chronomedicine is reviewed. Chronopharmacology and chronotherapy is considered as a new stage in clinical medicine. It is concluded that chronomedicine is a qualitatively new approach to clinical medicine, applicable not only to the investigation of pathology in terms of function and morphology, but also to the study of temporal links with the environment. B. J.

A84-17296

**CRYOFRACTOGRAPHY OF MICROVESSEL ENDOTHELIUM [KRIOFRAKTOGRAFIYA ENDOTELIIA MIKROSOSUDOV]**

I. A. KARAGANOV, G. A. ALIMOV, V. A. MIRONOV, and A. A. MIRONOV (II Moskovskii Gosudarstvennyi Meditsinskii Institut, Moscow, Ivanovskii Meditsinskii Institut, Ivanov, USSR) Arkhiv Anatomii, Gistologii i Embriologii (ISSN 0004-1947), vol. 84, June 1983, p. 5-24. In Russian. refs

The methodology of cryofractography is described, and a critical analysis of cryofractographic data pertaining to the study of blood-microvessel endothelium is presented. Particular attention is given to pathways of transendothelial transport in microvessels. B. J.

A84-17297

**CYTOARCHITECTONICS OF FRONTAL AREA FIELDS OF THE CEREBRAL CORTEX IN PAPIO HAMADRYAS AND MACACA RHESUS IN ONTOGENY [TSITOARKHITEKTONIKA POLEI LOBNOI OBLASTI KORY BOL'SHOGO MOZGA U PAVIANA GAMADRYLA I MAKAKA REZUSA V ONTOGENEZE]**

N. S. ORZHEKHOVSKAIA (Akademiia Meditsinskikh Nauk SSSR, Moscow, USSR) Arkhiv Anatomii, Gistologii i Embriologii (ISSN 0004-1947), vol. 84, June 1983, p. 25-33. In Russian. refs

A84-17300

**BLOOD FILLING OF THE ADRENAL CORTEX IN WHITE RATS, INTACT AND SUBJECTED TO ACUTE OVERHEATING [KROVENAPOLNENIE KORY NADPOCHETNIKOV INTAKTNYKH I PODVERGNUTYKH OSTROMU PEREGREIVANIU BELYKH KRY]**

M. K. PUGACHEV (Smolenskii Meditsinskii Institut, Smolensk, USSR) Arkhiv Anatomii, Gistologii i Embriologii (ISSN 0004-1947), vol. 84, June 1983, p. 58-62. In Russian. refs

A84-17766

**RADIATION BIOPHYSICS IN SPACE - TWO EXPERIMENTS ON THE FIRST SPACELAB MISSION [STRAHLENBIOPHYSIK IM WELTRAUM - ZWEI EXPERIMENTE BEI DER ERSTEN SPACELAB-MISSION]**

H. BUECKER and G. HORNECK (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Flugmedizin, Cologne, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), vol. 40, Nov. 1983, p. 17, 18. In German.

The scientific goals and apparatus of the Advanced Biostack experiment and the experiment on microorganisms and biomolecules in free space flown on the first Spacelab mission (fall, 1983) are characterized. These experiments are seen as continuations of the Biorack series (on Apollo 16 and 17 and the Apollo-Soyuz Test Project) and the NASA experiment, Microbial Response to Space Environment (Apollo 16); results of these experiments are summarized. The Advanced Biostack experiments concentrate on the effects of cosmic HZE particles on biological materials of different complexity levels and in different stages of activity or development, using the Biostack design of alternating sample and radiation-detector layers. The microbe experiment seeks to compare the earlier findings on the effects of 254-nm UV radiation and space vacuum on bacterial spores to other regions of the UV spectrum. A total of 316 samples are exposed to solar radiation for 12 h. T. K.

A84-17767

**DEVELOPMENT AND FUNCTION OF ORGANISMS IN WEIGHTLESSNESS - TWO EXPERIMENTS FOR THE FIRST GERMAN SPACELAB MISSION D1 [ENTWICKLUNG UND FUNKTION VON ORGANISMEN IN SCHWERELOSIGKEIT ZWEI EXPERIMENTE BEI DER DEUTSCHEN SPACELAB-MISSION D1]**

J. NEUBERT and V. SOBICK (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Flugmedizin, Cologne, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), vol. 40, Nov. 1983, p. 19-22. In German.

The scientific aims, principles and design of the STATEX and Physarum experiment packages being designed for the D1 mission (planned for June, 1985) are discussed. STATEX will investigate the effects of microgravity on the development of the statolith organs of frogs (*Xenopus laevis*) in just-fertilized eggs and tadpoles of various ages. The experimental apparatus is described, and the operational protocol (including the 140-h growth period) is illustrated with a block diagram. The second experiment (part of the ESA Biorack) uses 16-mm film and a photodiode array, coupled with a light microscope, to observe the effects of microgravity on the rhythmic contraction behavior of the actomyosin-containing vessel walls of the monocellular slime mold *Physarum polycephalum*. Both experiment packages employ centrifuges to simulate earth gravity for the control groups, and their other major components have been successfully tested in zero-gravity simulations on earth. T. K.

**A84-17775\*** National Aeronautics and Space Administration  
Ames Research Center, Moffett Field, Calif  
**OXYGEN REQUIREMENTS FOR FORMATION AND ACTIVITY  
OF THE SQUALENE EPOXIDASE IN SACCHAROMYCES  
CEREVISIAE**

L JAHNKE and H P KLEIN (NASA, Ames Research Center,  
Extraterrestrial Research Div., Moffett Field, CA) *Journal of  
Bacteriology* (ISSN 0021-9193), Aug 1983, p 488-492 refs

The effect of oxygen on squalene epoxidase activity in  
*Saccharomyces cerevisiae* was investigated. In cells grown in  
standing cultures, the epoxidase was localized mainly in the  
'mitochondrial' fraction. Upon aeration, enzyme activity increased  
and the newly formed enzyme was associated with the 'microsomal'  
fraction. At 0.03 percent (vol/vol) oxygen, epoxidase levels doubled,  
whereas the ergosterol level was only slightly increased. Cycloheximide  
inhibited the increase in epoxidase under these conditions. An apparent  
 $K_{\text{sub m}}$  for oxygen of 0.38 percent (vol/vol) was determined from a  
crude particulate preparation for the epoxidase. Author

**A84-17820\*** Colorado Univ., Boulder  
**EFFECTS OF NITRIC OXIDE AND NITROGEN DIOXIDE ON  
BACTERIAL GROWTH**

R L MANCINELLI (Colorado, University, Boulder, CO) and C P  
MCKAY (NASA, Ames Research Center, Space Science Div.,  
Moffett Field, CA) *Applied and Environmental Microbiology* (ISSN  
0099-2240), July 1983, p 198-202 refs

While it is generally thought that the bactericidal effects of NO  
and NO<sub>2</sub> derive from their reaction with water to form nitrous and  
nitric acids (Shank et al., 1962), this appears to be true only at  
high concentrations. The data presented here suggest that at low  
NO and NO<sub>2</sub> concentrations, acids are not present in high enough  
concentrations to act as toxic agents. Reference is made to a  
study by Grant et al. (1979), which found that exposing acid forest  
soil to 1 ppm of NO<sub>2</sub> did not cause the soil pH to drop. The  
results presented here show that at low concentrations of NO  
and NO<sub>2</sub>, the NO is bacteriostatic for some organisms and not  
for others, whereas NO<sub>2</sub> may protect some bacteria from the  
inhibitory effects of NO. Since it has been shown that bacteria  
can divide while airborne (Dimmick et al., 1979), the present results  
suggest that NO at the low concentrations found in the atmosphere  
can select for resistant bacteria in the air and affect the viable  
airborne bacterial population. C R

**A84-18493**  
**CELLS AT REST: PROPERTIES AND FUNCTIONS IN THE  
ORGANISM [POKOIASHCHIESIA KLETKI: SVOISTVA I  
FUNKTSII V ORGANIZME]**

O I EPIFANOVA, V V TERSKIKH, and V A POLUNOVSKII  
Moscow, Izdatel'stvo Nauka, 1983, 184 p. In Russian refs

The significance of the state of rest in the life activity of cells  
is assessed. An attempt is made to answer the questions, for  
what reason and in what manner a cell has acquired the ability to  
interrupt periodically its reproduction and pass into a state of rest,  
in which it not only remains vital (i.e., capable of reproducing) but  
also becomes more stable to adverse environmental effects. The  
state of rest is examined as a metabolically active and reversible  
state of the cell. Attention is given to the significance of the  
disturbance of normal regulation mechanisms for the aging and  
pathological growth of cells. It is concluded that the ability of  
cells to pass into a state of rest with a special type of metabolism  
may have developed in the process of evolution in connection  
with the experience of adverse environmental conditions, which  
did not provide for the active proliferation of cells. B J

**A84-18495**  
**REGULATION OF ARTERIAL PRESSURE UNDER NORMAL AND  
PATHOLOGICAL CONDITIONS [REGULIATSIIA  
ARTERIAL'NOGO DAVLENIIA V NORME I PRI PATOLOGII]**

V A ALMAZOV, V A TSYRLIN, N P MASLOVA, A A TEMIROV,  
and A V SHABROV Leningrad, Izdatel'stvo Nauka, 1983, 160  
p. In Russian refs

Mechanisms underlying the regulation of arterial pressure under  
normal conditions and in cases of various types of arterial  
hypertension (labile, stable, of renal origin, and of endocrine origin)  
are examined. An analysis is made of the role of neurogenic  
mechanisms and humoral factors of blood circulation regulation in  
regulating arterial pressure in patients with arterial hypertension.  
The significance of various parts of the central nervous system in  
regulating arterial pressure is examined. Attention is given to  
mechanisms determining changes of blood minute volume and  
vessel tonus during the development and stabilization of arterial  
hypertension. B J

**A84-18497**  
**FUNCTIONAL EVOLUTION OF THE CENTRAL NERVOUS  
SYSTEM [FUNKSIONAL'NAIA EVOLIUTSIIA TSENTRAL'NOI  
NERVNOI SISTEMY]**

E M KREPS, ED Leningrad, Izdatel'stvo Nauka, 1983, 65 p. In  
Russian

Papers are presented on such topics as periodic phenomena  
in the sensorimotor cortex of rats and their relationship with  
autogenic motor activity, the structural-functional organization of  
the forebrains of bony fishes, neuron responses of the sturgeon  
middle brain to weak electrical stimuli, and functional characteristics  
of the auditory system of certain types of insect-eating mammals.  
Consideration is also given to polymorphism in the behavior of  
the *Emys orbicularis* turtle as it solves an extrapolation problem,  
the structure of the sturgeon forebrain, and the genesis of the  
olfactory off-response in fishes. No individual items are abstracted  
in this volume. B J

**A84-18504**  
**THE BLOOD-COAGULATION SYSTEM AND ADAPTATION TO  
NATURAL HYPOXIA [SISTEMA SVERTYVANIYA KROVI I  
ADAPTATSIYA K PRIRODNOI GIPOKSII]**

V A ISABAEVA Leningrad, Izdatel'stvo Nauka, 1983, 152 p. In  
Russian refs

The effects of high-altitude conditions on the hemostasis system  
of humans and animals are examined on the basis of data for the  
Tien-Shan, Alay, and Pamir mountain ranges. Consideration is given  
to the following problems: the effect of mountain climate on the  
blood-coagulation system, ecological-geographic and  
species-related characteristics of the blood-coagulation system in  
humans and animals on mountain ranges, the adaptive response  
of hemostasis during short-term and long-term adaptation to  
high-altitude conditions, and individual sensitivity and stability of  
blood coagulation with respect to the effect of high-altitude  
conditions and extreme factors. Adaptive changes occurring in  
the blood-coagulation system under the effects of combined  
environmental factors (hypoxia, temperature, etc.) are examined  
along with neurohormonal mechanisms for the regulation of the  
hemostasis function in the adaptation to high-altitude conditions. B J

**A84-18505**  
**CHEMICAL ENZYMOLOGY [KHIMICHESKAIA ENZIMOLOGIIA]**

I V BEREZIN, ED and K MARTINEK, ED Moscow, Izdatel'stvo  
Moskovskogo Universiteta, 1983, 280 p. In Russian

The relationship between fermentative (biological) and  
homogeneous (chemical) catalyses is analyzed from a  
physicochemical, and similarities in their mechanisms are pointed  
out. In addition to the theory of enzymes, the current and future  
applications of enzymes are discussed. In particular, attention is  
given to the use of immobilized enzymes in organic synthesis,  
chemical analysis (the bioluminescence method), medicine, and  
chemical industry. No individual items are abstracted in this  
volume. V L

**A84-18745**  
**NEURONAL ORGANIZATION OF CONDITIONED-REFLEX BEHAVIOR** [NEIRONNAIA ORGANIZATSIIA USLOVNOREFLEKTORNOGO POVEDENIIA]  
 B I KOTLIAR, V I MAIOROV, N O TIMOFEEVA, and V V SHULGOVSKII Moscow, Izdatel'stvo Nauka, 1983, 177 p In Russian refs

Neuronal mechanisms of conditioned-reflex behavior are examined on the basis of laboratory-model data. Particular consideration is given to functional phenomena participating in the formation and realization of conditioned reflexes, the neurosubstrate of the associative function of the brain, and the integrative properties of the nerve cell. B J

**A84-18998**  
**ELECTRICAL RESPONSES OF ANTERIOR ROOTS TO BULBAR PYRAMID AND LABYRINTH STIMULATION IN ANIMALS WITH A DENERVATED LIMB** [ELEKTRICHESKIE OTVETY PEREDNIKH KORESHKOV PRI STIMULIATSII BUL'BARNYKH PIRAMID I LABIRINTA U ZHIVOTNYKH S DENERVIROVANNOMI KONECHNOST'YU]  
 I IA SERDIUCHENKO, P I SIABRO, and E A MAKII (Dnepropetrovskii Meditsinskii Institut, Dnepropetrovsk, Ukrainian SSR) Fiziologicheskii Zhurnal /Kiev/ (ISSN 0201-8489), vol 29, Nov-Dec 1983, p 679-683 In Russian refs

**A84-18999**  
**MORPHOFUNCTIONAL ORGANIZATION OF STRUCTURES OF THE VENTRAL SURFACE OF THE MEDULLA OBLONGATA, PARTICIPATING IN THE REGULATION OF BLOOD CIRCULATION** [MORFO-FUNKSIONAL'NAIA ORGANIZATSIIA STRUKTUR VENTRAL'NOI POVERKHNOSTI PRODOLGOVATOGO MOZGA, UCHASTVUIUSHCHIKH V REGULIATSII KROVOOBRAZHENIYA]  
 M I GUREVICH and A G. KARTSEVA (Akademiia Nauk Ukrainskoi SSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal /Kiev/ (ISSN 0201-8489), vol 29, Nov-Dec 1983, p 722-730 In Russian refs

**A84-19028**  
**TASK-RELEVANT LATE POSITIVE COMPONENT OF THE AUDITORY EVENT-RELATED POTENTIAL IN MONKEYS RESEMBLES P300 IN HUMANS**  
 D L ARTHUR and A STARR (California, University, Irvine, CA) Science (ISSN 0036-8075), vol 223, Jan 13, 1984, p 186-188 refs  
 (Contract PHS-MH-14599-06, NIH-NS-11876-08)

A long-latency (300-millisecond), vertex-positive component of the event-related potential recorded from monkeys was present only when the eliciting stimulus was relevant to the task. The amplitude of this component varied inversely with stimulus probability and was dissociable from motor responses. Author

**A84-19038**  
**EVIDENCE FOR A CENTRAL COMPONENT OF POST-INJURY PAIN HYPERSENSITIVITY**  
 C J WOOLF (University College, London, England) Nature (ISSN 0028-0836), vol 306, Dec 15, 1983, p 686-688 Research supported by the Medical Research Council of England refs

Stimuli causing injury to skin tissues often generate poststimulus pain, increased sensitivity to stimuli, and pain following even innocuous stimuli, either through the sensitization of skin nociceptors or an increase in the excitability of the central nervous system. Because a sensitization of peripheral receptors occurs after injury, a peripheral mechanism is widely held responsible for postinjury hypersensitivity. An animal model is presented in which the changes that occur in the threshold and responsiveness of the flexor reflex following peripheral injury are analogous to the sensory changes found in man. An electrophysiological analysis of the increased flexion reflex excitability shows it to arise in part from spinal chord activity changes. O C

**N84-14661#** Canada Inst for Scientific and Technical Information, Ottawa (Ontario)  
**SUGGESTIONS CONCERNING TECHNOLOGICAL RESEARCH AND DEVELOPMENT FOR THE PURPOSE OF INDUSTRIAL USE OF MARINE ALGAE Final Report**  
 B HAHN-HAEGERDAL 1983 26 p refs Transl into ENGLISH of Rept no 80-3445 National Swedish Board for Tech. Development, Lund (Sweden), 28 Oct 1981 p 1-25 (ISSN-0077-5606, NRC/CNR-IT-2071) Avail NTIS HC A03/MF A01

Selection of new algae species in respect to parasite and disease resistance, adjustment to cultivation and harvest systems, and the profitability in respect to the technologically important components, development of cultivation systems suitable for the Swedish conditions, joint cultivation of fish, mussels, oysters and crustaceans with algae, cultivation of algae in certain municipal waste waters, development of harvesting systems, methane-fermentation, fatty acid - hydrocarbon production as an alternative to the methane fermentation, physical-chemical properties of the marine polysaccharides in relation to their technical properties, and marine algae as a food or fodder supplement are discussed. N W

**N84-14662#** Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div  
**THE ULTRASTRUCTURAL ORGANIZATION OF THE BLUE-GREEN ALGA MICROCYSTIS AERUGINOSA KUETZ. EMEND. ELENK IN CONNECTION WITH TOXICOGENESIS**  
 A A AVAKYAN and O I BAULINA 24 Aug 1983 11 p Transl into ENGLISH from Zh Mikrobiol, Epidemiol Immunobiol (USSR), v 49, no 8, Aug 1972 p 106-109 + 1 (AD-A132540, FTD-ID(RS)T-0764-83) Avail NTIS HCA02/MFA01 CSCL 06C

The majority of strains of the blue-green algae *Microcystis aeruginosa* produce a very strong toxin. Water reservoirs, where blue-green algae abound, become toxic. The ultrastructure of this algae contains the knowledge for toxin formation. This necessitates further study. Author

**N84-14663#** Rhode Island Univ, Kingston  
**THE ROLE OF OXYGEN RADICALS IN BIOLOGY AND MEDICINE**  
 1983 24 p Conf held in Ventura, Calif, 7-11 Feb 1983 (Contract N00014-82-G-0107) (AD-A133053) Avail NTIS HCA02/MFA01 CSCL 06A

The chemistry of oxygen radicals, biological oxidations, biochemistry of oxygen radicals, antioxidants, biological impacts (prostaglandin/inflammation, cancer/pathology, and aging blood) are discussed. N W

**N84-14664#** Randomline, Inc., Huntingdon Valley, Pa  
**BEHAVIORAL AND PRENATAL EFFECTS OF 60-HZ FIELDS**  
 Aug 1983 26 p (Contract DE-AC02-80RA-50293) (DE84-001126, DOE/RA-50293/1) Avail NTIS HC A03/MF A01

The purpose was to determine possible neural, behavioral, and reproductive effects of low intensity 60-Hz electric fields on mammals (rats) exposed in utero. The tests used shortly after birth included negative geotaxis, the acoustic startle response, surface righting, in air righting, cliff avoidance, emotionality, and swimming endurance. Variations between the exposed and control groups are discussed. DOE

**N84-15190#** Council for Scientific and Industrial Research, Pretoria (South Africa)  
**BIOLOGICAL CHEMISTRY**  
*In its Activities of the National Chemical Research Lab* p 19-28 1982  
 Avail NTIS HC A07/MF A01

Research aimed at increasing basic knowledge of the factors influencing digestion and metabolism in ruminants is described. Specific investigations include the number and types of

## 51 LIFE SCIENCES (GENERAL)

fiber-digesting bacteria in the rumen of sheep fed increasing amounts of maize grain, influence of starch and sugars on the digestion of cellulose by rumen bacteria, the effects of pH, Na(+), and osmolality on the growth of rumen bacteria, and the breakdown and synthesis of protein in the rumen  
M G

**N84-15755\*#** Oregon Health Sciences Univ, Portland Dept of Neurology

### COUNTERCURRENT DISTRIBUTION OF BIOLOGICAL CELLS Final Report, 16 Nov. 1979 - 31 Dec. 1982

D E. BROOKS 1982 86 p refs

(Contract NAS8-33575)

(NASA-CR-170958, NAS 1 26 170958) Avail NTIS HC A05/MF A01 CSCL 06C

Detailed physicochemical studies of dextran/poly(ethylene glycol) (PEG) two phase systems were carried out to characterize and provide understanding of the properties of the systems which determine cell partition and the electrophoretic behavior of phase drops responsible for electric field driven phase separation. A detailed study of the electrostatic and electrokinetic potentials developed in these systems was carried out. The salt partition was examined both in phase systems and with pure polymer solutions via equilibrium dialysis and mechanism of sulfate, chloride and phosphate partition shown to be exclusion by PEG rather than binding by dextran. Salt partition was shown to have a strong effect on the polymer compositions of the phases as well, an effect which produces large changes in the interfacial tension between them. These effects were characterized and the interfacial tension shown to obey a power law with respect to its dependence on the length of the tie line describing the system composition on a phase diagram. The electrostatic potential differences measured via salt bridges were shown to obey thermodynamic predictions. The electrophoretic mobilities measured were utilized to provide a partial test of Levine's incomplete theory of phase drop electrophoresis. The data were consistent with Levine's expression over a limited range of the variables tested  
Author

**N84-15756#** Washington Univ, Seattle Bioelectromagnetics Research Lab

### EFFECTS OF LONG-TERM LOW-LEVEL RADIOFREQUENCY RADIATION EXPOSURE ON RATS. VOLUME 1: DESIGN, FACILITIES, AND PROCEDURES Final Report, Jun. 1980 - Dec. 1982

A W GUY, C K CHOU, R B JOHNSON, and L L KUNZ Sep 1983 83 p

(Contract F33615-80-C-0612, AF PROJ 7757)

(AD-A134079, SR-18-VOL-1, SAM-TR-83-17-VOL-1) Avail NTIS HCA05/MFA01 CSCL 06R

This is the first of a series of reports on the effects of long-term low-level RFR exposure on rats. The design, facilities, and procedures for exposing 100 experimental and 100 sham-exposed rats to 2450-MHz pulsed electromagnetic fields are described. The rats were exposed to 10-microsecond pulsed microwaves at 800 pps and 8-Hz modulation for 21 h per day for 25 months at an average power density of 480 microwatts/sq cm. The maximum specific absorption rate in rats was 0.4 W/kg. Reports on individual endpoints are presented in subsequent reports  
GRA

**N84-15757#** Harvard Univ, Cambridge, Mass Lab of Microbial Ecology.

### THE ROLE OF MICROORGANISMS IN MARINE CORROSION PROCESSES Annual Technical Report, 1 Jul. 1982 - 30 Jun. 1983

R MITCHELL, M WALCH, and F TOMEI Apr 1983 46 p

(Contract N00014-81-K-0624)

(AD-A133113, ATR-2) Avail NTIS HCA03/MFA01 CSCL 06M

This report describes research into the role of bacteria in marine corrosion processes. During the past year we have studied four aspects of biological corrosion, the mechanisms of attachment of bacteria involved in corrosion to metal surfaces, corrosion by extremely thermophilic bacteria, anaerobic corrosion processes, and hydrogen embrittlement. Both quantitative and qualitative differences in the attachment microflora were detected on different

metal surfaces. Hydrophobicity of the bacteria appears to control specificity of attachment. Extremely thermophilic bacteria appear to be common on surfaces in contact with hot water. Bacteria are well known as catalysts in anaerobic corrosion processes. Bacteria appear to play an important role in hydrogen embrittlement of metals. Bacteria capable of producing large quantities of bacteria are found in microbial biofilms on metal surfaces  
GRA

**N84-15758#** Letterman Army Inst of Research, San Francisco, Calif Toxicology Group

### ACUTE INTRAMUSCULAR TOXICITY (LD50) OF 1,1'-TRIMETHYLENEBIS (4-(HYDROXYIMINOMETHYL) PYRIDINIUM BROMIDE) MONOHYDRATE, (TMB-4) IN MALE MICE Final Report, 9 Jun. - 1 Jul. 1982

C W WHITE, L J SAUERS, T P KELLNER, and J T FRUIN Aug 1983 27 p

(AD-A133148, LAIR-158, TOXICOLOGY-SER-42) Avail NTIS HCA03/MFA01 CSCL 06T

The acute intramuscular toxicity of 1,1'-trimethylenebis(4-(HYDROXYIMINO-METHYL) PYRIDINIUM BROMIDE monohydrate (TMB-4) (TW006) was determined in male ICR mice by using the single dose method LD1, LD50, LD95 with their 95% confidence limits were calculated by probit analysis. The LD50 was 100 mg/kg with the 95% confidence limit (91 mg/kg, 110 mg/kg). The TMB-4 formulation falls in the very toxic range  
Author (GRA)

**N84-15759#** OPTRA, Inc, Everett, Mass

### RAPID IDENTIFICATION OF MICRO-ORGANISMS

M HERCHER and K MEAD Aug 1983 13 p

(Contract DAAG29-82-C-0011)

(AD-A132831, ARO-18828 1-LS-S) Avail NTIS HCA02/MFA01 CSCL 06M

Research reported here is concerned with an investigation of two new fluorescent techniques for the rapid identification of microorganisms: (1) membrane potential dyes for the discrimination of viable microorganisms in particulate samples, and (2) a proprietary immunofluorescent technique which will allow the individual presence of several different antigens to be detected in a single measurement  
GRA

### N84-15760# School of Aerospace Medicine, Brooks AFB, Tex DURATION OF MEMORY LOSS DUE TO ELECTRON BEAM EXPOSURE Final Report, Jan. - May 1983

T G WHEELER and B M TILTON Aug 1983 12 p

(Contract AF PROJ 7757, U99QMXM)

(AD-A132941, SAM-TR-83-33) Avail NTIS HCA02/MFA01 CSCL 06R

Electron beam exposure has been shown to produce retrograde amnesia (RA). The objective of this study was to determine the duration of memory loss upon electron beam exposure. It is important to know if exposure produces a memory loss of the events which occurred in the preceding 1 sec or memory loss of the preceding minute's events. The task was a single-trial avoidance paradigm. The animal was placed in a small aversive chamber. After a 90-sec adaptation period, a door opened that provided access to a large, dark, preferred chamber. The time required for the animal to enter the preferred chamber was the measure of interest (T). Once inside the preferred chamber, a 1-sec footshock was delivered. Following the footshock by some preset delay (delta T), the animal was exposed to a 10-microsec, 10-rad electron beam (or X-ray). A second trial on the task was run 2 hr postexposure. The second trial consisted of placing the animal in the aversive chamber and monitoring the time (T') required to enter the preferred chamber. If the electron beam exposure interfered with the animal's ability to recall the shock, T' would be greatly reduced as compared with the sham controls. The exposure delay times used were delta T = 1, 3, 5, and 10 sec  
GRA

## AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation, and weightlessness

**N84-15761#** Wisconsin Univ, Madison Dept of Medical Physics

**BONE BLOOD FLOW MEASURED BY (41)AR CLEARANCE FORMED BY (44)CA(N<sub>1</sub>-) (41)AR**

M S. ROSENTHAL, P M DELUCA, JR, D W PEARSON, and R J NICKLES 1983 18 p refs

(Contract DE-AC02-76EV-01105)

(DE83-017600, DOE/EV-01105/304) Avail: NTIS HC A02/MF A01

A technique to measure regional inert gas washout in bone, in vivo, by measuring (41)Ar clearance formed by fast-neutron activation of (44)Ca was developed. Following fast neutron irradiation of whole rats, the perfusion-limited clearance of (41)Ar was measured for both dead and living rats. It is indicated that in the clearance rate for the live rats the bone perfusion is in the range of 3 to 20 ml/100 Argon distribution volume. DOE

**N84-15762#** California Univ, Berkeley Lawrence Berkeley Lab Biology and Medicine Div

**LETHAL, POTENTIALLY LETHAL LESION MODEL**

S B CURTIS Jul 1983 25 p refs Presented at the 7th Intern. Congr. of Radiation Res, Amsterdam, 4-9 Jul 1983 and at the 11th L. H. Gray Conf, Glasgow, 18-22 Jul 1983

(Contract DE-AC03-76SF-00098)

(DE84-001325, LBL-16549, CONF-830782-2) Avail: NTIS HC A02/MF A01

A theoretical framework to describe the formation of lethal mutations by radiation is presented. Lesions that are repaired and misrepaired are assumed to be the same. In this model the same lesions cause both sublethal and potentially lethal damage. Potentially lethal damage is damage which may be modified by alterations in postirradiation conditions. Sublethal damage is cellular damage whose accumulation may lead to lethality. The expression of the damage and the kind of medium in which the cells are placed during the repair period is considered. Fresh or growth medium (F-medium) is assumed to cause fixation of damage after about 3 hours, while no fixation occurs in conditioned medium (C-medium). DOE

**N84-16027\*#** Jackson State Univ, Miss Dept of Biology  
**A PRELIMINARY SURVEY OF PLANKTON AND PERIPHYTON IN THE TURN BARGE CANAL AND BASIN AREA OF KENNEDY SPACE CENTER, FLORIDA**

G D BARNES /in Alabama Univ Res Rept. 1983 NASA/ASEE Summer Faculty Fellowship program 26 p Dec 1983 refs  
Avail: NTIS HC A99/MF A01 CSDL 06C

While thirty-seven species of various groups of organisms were identified at the five stations at KSC, further sampling is needed to further enumerate and identify phytoplankton and periphyton for the long term monitoring program and assessment for a probable polygeneration site. Thallophyta, Cyanophyta coccoid and Chrysophyta pennate were the dominant organisms. Chlorobium was the most abundant Thallophyta. Pennate diatoms were larger and more abundant at station one. The absence of Skeletonema costatum was surprising. Stations four and five appear to be acid marsh swales. Rhabdoderma lineare, a Cyanophyta coccoid found in acid lakes, was abundant in stations four and five. A R H.

**A84-16177**

**DYNAMICS OF CARDIAC OUTPUT AND SYSTOLIC TIME INTERVALS IN SUPINE AND UPRIGHT EXERCISE**

Y MIYAMOTO, J HIGUCHI, Y ABE, T HIURA, Y NAKAZONO, and T. MIKAMI (Hokkaido University, Sapporo, Japan) Journal of Applied Physiology, Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1674-1681 refs

Data on the dynamic response of cardiac output and systolic time intervals were gathered during supine and upright exercises by a computer-based system. A constant-current impedance plethysmograph was wired to the computer, two band electrodes around the neck, a third electrode around the thorax at the xyphoid level, and a fourth encircling the abdomen between the xyphoid and the umbilicus. A constant current of 350 micro-A and 50 kHz was passed between the electrodes. ECG monitoring was also performed. Measurements were taken during upright and supine ergometer trials. The results were analyzed in terms of transient and steady-state responses. There was no significant reduction in the difference between the supine and upright positions. The preloads are therefore the dominant factor in the circulatory behavior. The sympathetic stimuli excited during exercise did not overcome the difference. M S K.

**A84-16178**

**INTERSUBJECT VARIABILITY IN GROWTH HORMONE TIME COURSE DURING DIFFERENT TYPES OF WORK**

J RAYNAUD, A CAPDEROU, J-P MARTINEAUD, J BORDACHAR, and J DURAND (Paris XI, Universite, Le Plessis-Robinson, Hauts-de-Seine, France) Journal of Applied Physiology, Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1682-1687. Research supported by the Universite Paris XI refs

The variability of response to various types of muscular exercise was examined with subjects selected for homogeneity of age, weight, and physical fitness. A total of nine subjects were fitted with a catheter in the antecubital vein, rested, and then performed ergometer exercise, with trials at different times covering exercise with restarting, heavy exercise, and continuous and intermittent exercise modes. The lung volume, heart rate, immunoreactive human growth hormone concentration (IRHGH), and rectal temperature were monitored. The onset and maximal value of the IRHGH were found to vary from subject to subject during the trials. The average values obtained were highly skewed by the presence of high values in any one performer. It is concluded that averaged results drawn from measurements with high variability are to be approached cautiously regarding the generalized interpretations that can be made. M S K.

**A84-16179\*** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

**HYPERVOLEMIA AND PLASMA VASOPRESSIN RESPONSE DURING WATER IMMERSION IN MEN**

J E GREENLEAF, J T MORSE, P R BARNES, J SILVER, and L C KEIL (NASA, Ames Research Center, Laboratory for Human Environmental Physiology, Moffett Field, CA) Journal of Applied Physiology, Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1688-1693 refs

Immersion studies were performed on seven mildly dehydrated male subjects to examine the effect of suppression of plasma vasopressin (PVP) on diuresis in water immersion. The water was kept at close to 34.5 C and the subjects remained in the water for 4 hr after sitting for 2 hr. Na and K levels in the serum and urine were analyzed, as were osmolality, red blood cell count,

renin activity, total protein, albumin amounts, hematocrit, and hemoglobin Plasma volume was monitored from samples drawn at specified intervals during immersion The plasma volume increased significantly 30 min after immersion, but no PVP was observed The dehydration induced elevated serum osmotic concentrations It is concluded that the hydration condition before immersion and the volume of fluid intake during immersion affects the hemodilution during immersion M S K

### A84-16180 VENTILATORY THRESHOLDS DURING SHORT- AND LONG-TERM EXERCISE

T REYBROUCK, J GHESQUIERE, A CATTART, R FAGARD, and A AMERY (Leuven, Katholieke Universiteit, Louvain, Belgium) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1694-1700 Research supported by the Instituut voor Wetenschappelijk Onderzoek in Nijverheid en Landbouw refs

An attempt was made to determine if trials involving long term, rather than graded, exercise are more suitable for identifying the underlying physical mechanisms that define a threshold beyond which ventilatory variables increase continuously without ever attaining a steady state Ergometer trials were performed by eight male subjects, at first in short term modes, then in graded increase and run duration gradient modes, and then in long duration modes Monitoring was carried out on the total oxygen uptake, the CO<sub>2</sub> output, arterial blood CO<sub>2</sub> partial pressure and pH, lactate concentration, and blood HCO<sub>3</sub><sup>-</sup> concentration The ventilatory threshold was higher during the long duration exercise, possibly due to a greater lactate clearance capability in the blood because of the steady-state conditions The lactate concentration was probably a critical indicator on the maximal endurance performance, as was the ventilatory threshold for long-term exercise M S K

### A84-16185 FRUCTOSE AND GLUCOSE INGESTION AND MUSCLE GLYCOGEN USE DURING SUBMAXIMAL EXERCISE

L LEVINE, W J EVANS, B S CADARETTE, E C FISHER, and B A BULLEN (Boston University, Boston, MA) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1767-1771 Research supported by Boston University and Hoffmann-La Roche Co refs

### A84-16186 EFFECT OF ACETAZOLAMIDE ON NORMOXIC AND HYPOXIC EXERCISE IN HUMANS AT SEA LEVEL

R B SCHOENE, P W BATES, E B LARSON, and D J PIERSON (Washington, University, Harborview Medical Center, Seattle, WA) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1772-1776 refs

Double-blind crossover type trials were run with six male subjects to examine the effect of acetazolamide on exercise parameters in normoxic and hypoxic conditions at sea level The subjects ingested either 250 mg acetazolamide or a placebo every 8 hr for a 24 hr period before ergometer trials ECG, oximetric, end-tidal O<sub>2</sub> and CO<sub>2</sub> concentrations, O<sub>2</sub> uptake, and CO<sub>2</sub> output were recorded The acetazolamide produced an increase in rest and exercise ventilation in hypoxic conditions, where O<sub>2</sub> saturation was higher It is suggested that the acetazolamide may permit longer endurance of submaximal exercise in hypoxic conditions by allowing a greater uptake of O<sub>2</sub> by the muscle tissues, as well as a higher ventilation rate M S K

### A84-16187

#### HYPHYDRATION AND HEAT ACCLIMATION - PLASMA RENIN AND ALDOSTERONE DURING EXERCISE

R P FRANCESCONI, M N SAWKA, and K B PANDOLF (U S Army, Research Institute of Environmental Medicine, Natick, MA) Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology (ISSN 0161-7567), vol 55, Dec 1983, p 1790-1794 refs

The influence of various factors which may alter the hormonal response to exercise in heat was examined experimentally Attention was focused on the plasma renin activity (PRA) and d-aldosterone (ALD) behavior in response to exercise, heat acclimation, and heat stress Consideration was also given to hypohydration and to simultaneous occurrence of heat acclimation and environmental adaptation Eight male and eight female subjects each participated in 12 trials, six before and six after heat acclimation trials The post- and pre-test activities comprised exposure to thermoneutral, hot-wet, and hot-dry environments The tests involved treadmill exercises for 140 min each session Gender had no significant effect, while hypohydration induced by 24 hr of abstinence from liquid intake before a test produced elevated PRA and ALD levels Heat acclimation moderated the increases in PRA but was ineffectual regarding the ALD All the variables affected the PRA and ALD to a measurable extent M S K

### A84-16344

#### MODEL OF STATIC ACCOMMODATIVE BEHAVIOR IN HUMAN AMBLYOPIA

G K HUNG, J L SEMMLOW (Rutgers University, Piscataway, NJ), K J CIUFFREDA, and S C HOKODA (New York, State University, New York, NY) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol BME-30, Oct 1983, p 665-672 refs

(Contract NIH-EY-03709, NIH-EY-03541)

A direct method for quantifying accommodative behavior in amblyopia is detailed in terms of an accommodative controller gain (ACG) value Experimental data are taken of the slope of the accommodative stimulus/response function, the accommodative bias, and the depth of focus A linear accommodation model is defined for calculating the ACG when the upper limit of the depth of field is less than the stimulus level A nonlinear accommodative model is also provided for the accommodative responses of normal eyes and dominant eyes of amblyopes Experimentation is described which demonstrates a consistently greater accommodative response in dominant eyes than in the amblyopic eyes of four subjects It is concluded that ACG is the primary model parameter in reduced accommodative responses in amblyopic eyes, while the dead space operator also has an effect M S K

### A84-16935

#### DETERMINING THE TIME REQUIRED FOR VISUAL PERCEPTION - METHODS AND RESULTS [OPREDELENIE VREMENI ZRITEL'NOGO VOSPRIIATIIA - METODIKA I REZUL'TATY]

A M IVANITSKII and I A KORSKOV (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Obshchei i Sudebnoi Psikhologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol 268, no 3, 1983, p 750-753 In Russian refs

The experiment described is carried out on 24 healthy persons Sitting in a darkened, sound-absorbing chamber, the subject sees two flashes, the second coming 1.2 sec after the first In some cases the flashes have the same brightness, in others the brightness differs The subject registers his perception of identical or differing brightness by the number of times he pushes a button The subject is also fitted with electrodes by which the slow electrical activity of the visual part of the cortex is measured and amplified A change in the sign of the first derivative of the slow electrical activity is found to be correlated with an incorrect opinion of the brightness of the flashes C R



**A84-17008****ELECTROPHYSIOLOGICAL CORRELATES OF HYPERACUITY IN THE HUMAN VISUAL CORTEX**

D M LEVI, R E MANNY, S A KLEIN, and S B STEINMAN (Houston, University, Houston, TX) *Nature* (ISSN 0028-0836), vol 306, Dec 1, 1983, p 468-470 refs  
(Contract NIH-R01-EY-01728, NIH-S07-RR-01747-09)

An electrophysiological correlate of hyperacuity recorded from the human visual cortex is reported. Subjects were exposed to repetitive vernier patterns on a computer monitor, the stimulus being five bright horizontal lines, each with three segments. The outer lines were displaced downward to introduce the vernier offset, then returned to their parallel formation. The EEG data from the subjects were averaged to correspond with the appearance of the vernier offset. The amplitude of the positive deflection of the recording trace varied systematically with the magnitude of the offset. The subthreshold of the displacement was established as 40 sec of arc, while 40 sec offsets produced significant responses. It is concluded that the visually evoked potentials recorded were induced by the appearance of relative positional data in the vernier stimulus by breaking colinearity. The results are considered significant for studies of spatial vision. M S K

**A84-17279****DEVELOPMENT OF CAPILLARIES IN THE HUMAN BRAIN [RAZVITIE KAPILLAROV MOZGA CHELOVEKA]**

A V LOMAKIN and V M CHERTOK (Vladivostokskii Meditsinskii Institut, Vladivostok, USSR) *Zhurnal Nevropatologii i Psikhatrii* im. S S Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p 1004-1007. In Russian refs

Gomori's method of alkaline phosphatase activity assessment and electron microscopy are used to investigate the development of capillaries in auditory, motor, and visual areas of the cerebral cortex in males ranging from 6-8 months of embryonic development to 60-80 years in age. It is found that the formation of cerebral capillaries continues in the course of the entire life of a human male. It is noted that the rate of capillary growth decreases with age, this feature being especially prominent in the 60-80 year age range. B J

**A84-17280****THE ROLE OF AFFECTIONS OF THE MAIN ARTERIES OF THE HEAD IN DISTURBANCES OF HEMOSTASIS AND THE RHEOLOGICAL PROPERTIES OF THE BLOOD [O ROLI PORAZHENII MAGISTRAL'NYKH ARTERII GOLOVY V NARUSHENIIAKH GEMOSTAZA I REOLOGICHESKIKH SVOISTV KROVI]**

E S GABRIELIAN, I U S TUNIAN, S E AKOPOV, B G BALAIAN, and G O BAKUNTS (Erevanskii Meditsinskii Institut, Yerevan, Armenian SSR) *Zhurnal Nevropatologii i Psikhatrii* im. S S Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p 1010-1014. In Russian refs

Platelet and erythrocyte aggregation was studied in blood passing through a chamber simulating an intact vessel and a vessel which is either stenosed or pathologically convoluted. Aggregate formation was shown to increase dramatically in the case of the simulation of a vessel section with an altered blood-flow geometry, this increase was much more pronounced when blood from patients with cerebral dyschemias was used. In patients with cerebral infarction, the antiaggregate activity of the blood passing through the internal carotid arteries on the affected side was found to be lower than in other sections of the blood stream. The significance of the disclosed features for the pathogenesis of cerebrovascular diseases is considered. B J

**A84-17281****RHEOLOGICAL PROPERTIES AND QUANTITATIVE SPECTRUM OF BLOOD PROSTAGLANDINS IN PATIENTS WITH HYPERTENSION [REOLOGICHESKIE SVOISTVA I KOLICHESTVENNYI SPEKTR PROSTAGLANDINOV KROVI U BOL'NYKH GIPERTONICHESKOI BOLEZNIU]**

Z A SUSLINA and V G VYSOTSKAIA (Akademii Meditsinskikh Nauk SSSR, Moscow, USSR) *Zhurnal Nevropatologii i Psikhatrii* im. S S Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p 1033-1038. In Russian refs

**A84-17283****MORPHOLOGICAL CRITERIA OF THE STRUCTURAL ASYMMETRY OF CORTEX AND SUBCORTEX FORMATIONS IN THE HUMAN BRAIN [MORFOLOGICHESKIE KRITERII STRUKTURNOI ASIMMETRII KORKOVYKH I PODKORKOVYKH OBRAZOVANII MOZGA CHELOVEKA]**

I N BOGOLEPOVA, V V AMUNTS, N S ORZHEKHOVSKAIA, and L I MALOFEEVA (Akademii Meditsinskikh Nauk SSSR, Moscow, USSR) *Zhurnal Nevropatologii i Psikhatrii* im. S S Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p 971, 975. In Russian refs

**A84-17284****LYMPHOCYTES IN THE HUMAN BRAIN [LIMFOTSITY V GOLOVNOY MOZGE CHELOVEKA]**

A I OIFA (Akademii Meditsinskikh Nauk SSSR, Moscow, USSR) *Zhurnal Nevropatologii i Psikhatrii* im. S S Korsakova (ISSN 0044-4588), vol 83, no 7, 1983, p 975-982. In Russian refs

The role of lymphocytes in the brains of schizophrenics is considered. Autopsies of 350 schizophrenics and 16 mentally healthy subjects who died at ages ranging from 15 to 87 years revealed the presence, in nearly 90 percent of the cases, of sparse segmentary clusters of small lymphocytes in the adventitia of vessels in the medulla oblongata irrespective of the cause of death. The biological role of lymphocytes in the brain is considered from the point of view of immunological tolerance. B J

**A84-17285****QUANTITATIVE HISTOENZYMOMOLOGICAL AND BIOCHEMICAL STUDY OF ATHEROGENESIS STAGES IN HUMAN CORONARY ARTERIES (BASED ON EARLY AUTOPSIES) [KOLICHESTVENNOE GISTOENZIMOLOGICHESKOE I BIOKHEMICHESKOE ISSLEDOVANIE ETAPOV ATEROGENEZA V KORONARNYKH ARTERIIAKH CHELOVEKA /PO MATERIALAM RANNIKH VSKRYTII/]**

E M TARARAK, G L ZELTSER, KH K AMINEVA, V F TRIUFANOV, and T I BOLSHAKOVA (Akademii Meditsinskikh Nauk SSSR, Moscow, Leningradskii Meditsinskii Institut, Leningrad, USSR) *Arkhiv Patologii* (ISSN 0004-1955), vol 45, no 6, 1983, p 14-19. In Russian refs

**A84-17286****CLINICAL-MORPHOLOGICAL CHARACTERISTICS OF THE THYMICOLYMPHATIC CONDITION IN ADOLESCENTS AND ADULTS [KLINIKO-MORFOLOGICHESKAIA KHARAKTERISTIKA TIMIKO-LIMFATICHESKOGO SOSTOIANIIA U PODROSTKOV I VZROSLYKH]**

M S POPOV and O V ZAIRATIANTS (I Moskovskii Meditsinskii Institut, Moscow, USSR) *Arkhiv Patologii* (ISSN 0004-1955), vol 45, no 6, 1983, p 60-67. In Russian refs

**A84-17288****LARGE MOLECULES IN SMALL DOSES [BOL'SHIE MOLEKULY V MALYKH DOZAKH]**

O LIBKIN *Khimiia i Zhizn'* (ISSN 0130-5972), July 1983, p 13-18. In Russian

A popular review of synthetic-polymer drug therapy is presented. The nature of such drugs is considered in themselves and as carriers, and a model of a synthetic-polymer drug is presented. Such drugs are examined as macromolecular therapeutic systems, and practical applications are discussed. B J



A84-17289

**SPRINT [SPRINT]**

M Z ZALESSKII Khimiia i Zhizn' (ISSN 0130-5972), July 1983, p 78-85 In Russian

The physiological bases underlying success in short-distance running (i.e., sprint) are examined. Particular consideration is given to the biochemical mechanisms and energetics of muscular activity, and to the role of catecholamines in the psychophysiology of sprint. The question of a speed limit to the 100-m and 200-m dashes is discussed. B J

A84-17291

**ON THE INVESTIGATION OF THE HEALTH OF SEAMEN OF THE ARCTIC FLEET [NEKOTORYE VOPROSY IZUCHENIIA SOSTOIANIIA ZDOROV'IA MORIAKOV SEVERNOGO FLOTA]**

N P BYCHIKHIN, G A ORLOV, V A POPOV, E F PISARENKO, and T V VASILEVA (Arkhangel'skii Meditsinskii Institut, Severnaia Tsentral'naia Basseinovaia Klinicheskaia Bol'nitsa, Arkhangelsk, USSR) Zdravookhranenie Rossiiskoi Federatsii (ISSN 0044-197X), no 7, 1983, p 7-10 In Russian

A study of seamen of the Soviet Arctic fleet shows that the morbidity of these seamen during voyages is dominated by respiratory sicknesses, and cutaneous and subcutaneous inflammations. In 23-25 percent of the cases studied these conditions lead to a temporary loss of work capacity. In addition, it is shown that the long-term effect of low temperature combined with high humidity causes neurovascular disorders of the extremities in some of the seamen, something which should be considered in making an occupational selection for Arctic conditions. B J

A84-17292

**ORGANIZATIONAL AND METHODOLOGICAL ASPECTS OF THE PROPHYLAXIS OF ARTERIAL HYPERTENSION AMONG TRANSPORT WORKERS**

[ORGANIZATSIONNO-METODICHESKIE ASPEKTY PROFILAKTIKI ARTERIAL'NOI GIPERTONII SREDI RABOTNIKOV TRANSPORTNOGO UPRAVLENIIA]

M L BEROV, A A ELGAROV, and A K GUCHEV (Kabardino-Balkarskii Gosudarstvennyi Universitet, Ministerstvo Zdravookhraneniia Kabardino-Balkarskoi ASSR, Kabardino-Balkarskoe Transportnoe Upravlenie, Nalchik, USSR) Zdravookhranenie Rossiiskoi Federatsii (ISSN 0044-197X), no 7, 1983, p 10-13 In Russian

A84-17293

**MEDICAL EXAMINATIONS OF WOMEN IN THE MEDICAL UNIT OF A LARGE INDUSTRIAL PLANT [O MEDITSINSKIKH OSMOTRAKH ZHENSCHIN V MEDIKO-SANITARNOI CHASTI KRUPNOGO PREDPRIIATIIA]**

E. O BULATOVA, M A SOLOVEVA, O S CHUGAEVA, V F KUZIN, and S L MURAVEVA Zdravookhranenie Rossiiskoi Federatsii (ISSN 0044-197X), no 7, 1983, p 22-24 In Russian

A84-17295

**THE EFFECT OF PROLONGED HYPOKINESIA ON THE HEMODYNAMICS AND CONTRACTILE FUNCTION OF THE MYOCARDIUM IN PATIENTS WITH ISCHEMIC HEART DISEASE AFTER LIMB AMPUTATION [VLIANIE DLITEL'NOI GIPOKINEZII NA GEMODINAMIKU I SOKRATITEL'NUIU FUNKTSIIU MIOKARDA U BOL'NYKH ISHEMICHESKOI BOLEZN'IU SERDTSIA POSLE AMPUTATSII KONECHNOSTEI]**

V A LIUSOV, L N KAZNACHEEV, and N I KATYSHKINA (Tsentral'nyi Nauchno-Issledovatel'skii Institut Protezirovaniia i Protezostroeniia, II Moskovskii Gosudarstvennyi Meditsinskii Institut, Moscow, USSR) Kardiologiya (ISSN 0022-9040), vol 23, June 1983, p 63-66 In Russian refs

A84-17298

**SIGNIFICANCE OF AORTA-BRANCHING CHARACTERISTICS IN THE REGULATION OF REGIONAL BLOOD FLOW IN HUMANS [ZNACHENIE OSOBNOSTEI VETVLENIIA AORTY V REGULIATSII REGIONAL'NOGO KROVOTOKA U CHELOVEKA]**

M A SRESELI and A G ORLOV (I Leningradskii Meditsinskii Institut, Leningrad, USSR) Arkhiv Anatomii, Gistologii i Embriologii (ISSN 0004-1947), vol 84, June 1983, p. 33-38 In Russian refs

A84-17299

**PATHWAYS OF LYMPH MOVEMENT IN THE CASE OF THE BLOCKING OF THE MEDIAL SUPERFICIAL LYMPHATIC VESSELS OF THE LOWER EXTREMITIES [PUTI DVIZHENIIA LIMFY PRI BLOKADE MEDIAL'NYKH POVERKHNOSTNYKH LIMFATICHESKIKH SOSUDOV NIZHNEI KONECHNOSTI]**

G V CHEPELENKO (Kurganskii Nauchno-Issledovatel'skii Institut Eksperimental'noi i Klinicheskoi Ortopedii i Travmatologii, Kurgan, USSR) Arkhiv Anatomii, Gistologii i Embriologii (ISSN 0004-1947), vol 84, June 1983, p 50-57 In Russian

A84-17822\* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

**ALTERATIONS IN CALCIUM HOMEOSTASIS AND BONE DURING ACTUAL AND SIMULATED SPACE FLIGHT**

T J WRONSKI and E R MOREY (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, CA) Medicine and Science in Sports and Exercise (ISSN 0195-9131), vol 15, no 5, 1983, p 410-414 refs

Skeletal alteration in experimental animals induced by actual and simulated spaceflight are discussed, noting that the main factor contributing to bone loss in growing rats placed in orbit aboard Soviet Cosmos biosatellites appears to be diminished bone formation. Mechanical unloading is seen as the most obvious cause of bone loss in a state of weightlessness. Reference is made to a study by Roberts et al (1981), which showed that osteoblast differentiation in the periodontal ligament of the maxilla was suppressed in rats flown in space. Since the maxilla lacks a weight-bearing function, this finding indicates that the skeletal alterations associated with orbital flight may be systemic rather than confined to weight-bearing bones. In addition, the skeletal response to simulated weightlessness may also be systemic (wronski and Morey, 1982). In suspended rats, the hindlimbs lost all weight-bearing functions, while the forelimbs maintained contact with the floor of the hypokinetic model. On this basis, it was to be expected that there would be different responses at the two skeletal sites if the observed abnormalities were due to mechanical unloading alone. The changes induced by simulated weightlessness in the proximal tibia and humerus, however, were generally comparable. This evidence for systemic skeletal responses has drawn attention to endocrine factors. C R

A84-18494

**SLOW NONELECTRICAL PROCESSES IN THE EVALUATION OF THE FUNCTIONAL CONDITION OF THE HUMAN BRAIN [MEDLENNYE NEELEKTRICHESKIE PROTSESSY V OTSENKE FUNKSIONAL'NOGO SOSTOIANIIA MOZGA CHELOVEKA]**

V B GRECHIN and V N BOROVIKOVA Leningrad, Izdatel'stvo Nauka, 1982, 176 p In Russian refs

The present work examines data pertaining to the dynamics of such slow nonelectrical processes in the human brain as oxygen tension, complex resistance, local temperature, and the extracellular activity of certain ions. These characteristics are compared with other types of indicators, including EEG and neuronal activity. Particular emphasis is placed on the possibility of using data concerning slow nonelectrical processes to elucidate mechanisms of brain function during mental activity. B J

A84-18755

**A HYGIENIC EVALUATION OF THE COMBINED EFFECT OF THE THERMAL AND NOISE-VIBRATION POLLUTION OF THE ENVIRONMENT ON THE HUMAN BODY [O GIGIENICHESKOI OTSENKE KOMBINIROVANNOGO VOZDEISTVIA TEPLOVOGO I SHUMO-VIBRATSIONNOGO ZAGRIAZNENIA SREDY NA ORGANIZM]**

F M SHLEIFMAN, A A MENSHOV, I D TASHKER, V A OSTROUKHOVA, N P BARANOVA, A L BARIL, and L B KUTSENKO (Ministerstvo Zdravookhraneniia Ukrainskoi SSR, Kievskii Nauchno-Issledovatel'skii Institut Gigiény Truda i Profzabolevanii, Kiev, Ukrainian SSR) Problemy Kontrolya i Zashchita Atmosfery ot Zagnazneniia (ISSN 0135-2253), no 8, 1982, p 91-94 In Russian refs

A84-18813

**BODY COMPOSITION (PERCENT FAT) AND HEAT STRESS OF WELL CONDITIONED YOUNG ADULT MALES**

M W RILEY, D J COCHRAN, and A J SOUNDY (Nebraska, University, Lincoln, NE) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 561-564 refs

The physiological responses of heart rate, oxygen consumption, sweat loss, rectal temperature and mean skin temperature were monitored as eight well-conditioned young adult males were exposed to effective temperatures of 70 F, 80 F and 90 F. The body fat contents of the subjects ranged from 11.3 to 34 percent. The subjects pedaled a 300 kilopond meters/minute load on a bicycle ergometer for 25 minutes. Results indicate that body fat or the percent of body fat squared have a statistically significant effect on the dependent variables of oxygen consumption/lean body weight, change in heart rate, core-skin temperature gradient, and oxygen consumption/maximum oxygen consumption. Author

A84-18890

**SPATIAL-FREQUENCY DISCRIMINATION AND DETECTION - COMPARISON OF POSTADAPTATION THRESHOLDS**

D REAGAN and K I BEVERLEY (Dalhousie University, Halifax, Canada) Optical Society of America, Journal (ISSN 0030-3941), vol 73, Dec 1983, p 1684-1690 Sponsorship Natural Sciences and Engineering Research Council of Canada refs (Contract NSERC-A-0323, AF-AFOSR-78-3711)

The effect of an adaptive sine-wave grating on spatial-frequency discrimination and contrast detection thresholds (DiT and DeT) is investigated experimentally, and the results are compared with model predictions. Adaptive gratings were viewed monocularly by each of two subjects and replaced for brief intervals by circular sine-wave test fields of varying spatial frequency and contrast. The results are presented in graph form and discussed. Both DiT and DeT were elevated by adaptive-grating inspection, but the DiT maximum occurred at a test-grating spatial frequency about twice that of the DeT maximum. Both increases were about halved by rotating the test gratings between 7 and 17 deg from the adaptive orientation. Models in which discrimination is determined by local processes with spatial interpolation, by the most-active-channel(s), or by the relative activities of psychophysical spatial-frequency channels (or size-tuned neural subunits) are introduced and considered in the light of the findings. The first model can predict the results (if a 'stuck grid' assumption is made), but the second is unable to do so; the physiological version of the relative-activity model is found most satisfactory and elaborated.

T.K

A84-18891

**INDEPENDENCE OF ORIENTATION AND SIZE IN SPATIAL DISCRIMINATIONS**

C A BURBECK (SRI International, Menlo Park, CA) and D REGAN (Dalhousie University, Halifax, Canada) Optical Society of America, Journal (ISSN 0030-3941), vol 73, Dec 1983, p 1691-1694 Sponsorship Natural Sciences and Engineering Research Council of Canada refs (Contract NSERC-A-0323, AF-AFOSR-78-3711, F49620-82-K-0024)

This study of form vision explores the relationships between orientation and spatial frequency in suprathreshold discrimination tasks. Orientation discrimination thresholds for sine-wave gratings were 0.3-0.5 deg, much less than the roughly 10-24-deg orientational bandwidth of channels; spatial-frequency discrimination thresholds were 3-7 percent, much less than the roughly 1-2-octave spatial-frequency bandwidth of channels. Spatial-frequency discrimination between two gratings was found to be as acute when the two gratings were orthogonal as when they were parallel. Orientation discrimination between two gratings was as acute when the two gratings had the same spatial frequencies as when they had different spatial frequencies. Thus orientation and spatial frequency are independent dimensions at the discrimination stage of spatial information processing. Author

A84-19000

**EFFECT OF THE ACOUSTIC REFLEX OF INTRAURAL MUSCLES ON THE LATENT PERIODS OF COMPONENTS OF THE COCHLEOMYOGENIC POTENTIAL, RECORDED DURING SHORT-TERM ACOUSTIC LOADING [VLIIANIE AKUSTICHESKOGO REFLEKSA VNUTRIUSHNYKH MYSHTS NA VELICHINU LATENTNYKH PERIODOV KOMPONENTOV KOKHLEOMIOGENNOGO POTENTSIALA, ZAREGISTROVANNOGO PRI DEISTVII KRATKOVREMENNOI ZVUKOVOI NAGRUZKI]**

T V SHIDLOVSKAIA and L N BUTENKO (Institut Otolaryngologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal /Kiev/ (ISSN 0201-8489), vol 29, Nov-Dec 1983, p 746-749 In Russian refs

A84-19294#

**COLOR MATCHES AND DISCRIMINATION FUNCTIONS FOR SELECTED HUES**

F E WARD (Wright State University, Dayton, OH), F GREENE, and W MARTIN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 249-253

The purpose of this research was to investigate color discrimination under conditions of ambient illumination that may reduce CRT display saturation and contrast. Both the variability of color matching and the offsets from a match necessary for a 100 percent discrimination difference were measured for four dominant wavelengths each at five saturation levels. Subjects were tested at low, medium, and high adaptation levels for both large and small test stimulus sizes. In general, results for the low luminance color matching conditions are in agreement with the published literature. For the high luminance and small field conditions, the data suggest that color discrimination should not be predicted from the CIE Uniform Chromaticity Space data. Color discrimination varies dramatically with dominant wavelength; reds and greens are more difficult to discriminate than yellows and yellow-greens.

Author

A84-19295#

**TIME OF DAY VARIATIONS IN STEADY-STATE ACCOMMODATION TO SQUARE-WAVE GRATINGS**

T L AMERSON (U.S. Naval Reserve, Medical Service Corps, Pensacola, FL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 254-258 refs

Time of day variations were studied both in the dark focus of accommodation and in steady-state accommodation. All subjects ( $n = 16$ ) were measured in the morning and again 12 hr later. The mean nighttime dark focus was 0.5 diopters (D) greater than the morning value. Overaccommodation to far targets (0 D) and underaccommodation to near targets (3.20 D) occurred for both 4.2 and 8.4 cycle/deg square-wave gratings. A shift in steady-state accommodation was found with the nighttime values being somewhat greater (0.25 D) than the morning values. Author

A84-19296#

**ACCOMMODATION AND THE ACQUISITION OF DISTANT TARGETS BY OBSERVERS WITH SUPERIOR VISION**

K MOFFITT (Systems Laboratories, Inc., Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 259-263 refs (Contract F33615-82-C-0511)

An account is given of a series of experiments and demonstrations conducted to study how a pilot might use his eyes to optimize target acquisition performance in different visual environments. Uncorrected far acuity of at least 20/20 was a prerequisite. Target acquisition tasks were performed while accommodation was simultaneously monitored with an infrared optometer. The target was always small and located at optical infinity. The average dark focus was more distant than is typically reported and tended to shift outward with experience on the optometer. When observers were provided with distance information, half were apparently able to 'look through' near peripheral texture in order to optimize accommodation accuracy and target detection performance. Observers' abilities to shift accommodation outward did not correlate with ability to look through near texture. Two observers were able to focus and defocus small targets on demand. D H

A84-19298#

**CONTRAST SENSITIVITY PREDICTS TARGET DETECTION FIELD PERFORMANCE OF PILOTS**

A P GINSBURG, J EASTERLY (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), and D W EVANS (U.S. Air Force Academy, Colorado Springs, CO) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 269-273 refs

Recent research has shown that contrast sensitivity, not visual acuity, can predict a pilot's ability to detect an air-to-ground target in a flight simulator. A further study is reported that shows a similar predictive power under actual field conditions. Eighty-four U.S. Air Force pilots, seated at the end of a runway, typically in groups of ten/week, reported the detection of an approaching T-39 jet aircraft under visibility conditions varying from 0.5 to over 15 miles for 10 field trials. The pilots' detection ranges were correlated with their individual contrast sensitivities and standard visual acuities. Contrast sensitivity, not visual acuity, was found to be a good predictor of detection range. These results have strong implications for the creation of performance-related vision standards. Author

A84-19303#

**INVESTIGATING THE STEADY STATE VISUALLY EVOKED CORTICAL RESPONSE**

A M JUNKER (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and K J PEIO (Systems Research Laboratories, Inc., Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 365-368 refs

Steady state visually evoked cortical responses were obtained by sinusoidally modulating fluorescent lights. Sums of sine waves with a frequency range of 5.5 Hz to 49 Hz were presented simultaneously to subjects to allow a control theoretic examination of the describing function of the EEG response. Subjects observed the stimulus in a 'lights only' condition and were also tested viewing the flickering lights while doing a video decision task presented in the same field. Results indicate that reconstruction of the describing function across several frequencies was consistent for replications of each condition. Differences between the decision condition and lights only were observed around 9.5 Hz to 11.5 Hz. Frequency dependent sensitivity to the evoking stimulus was observed, and individual differences were indicated in frequency sensitivity to the evoking stimuli. Author

**N84-14166# Joint Publications Research Service, Arlington, Va THE 5TH SYMPOSIUM ON GRAVITATIONAL PHYSIOLOGY**

In its USSR Rept Space, No 25 (JPRS-84946) p 82-84 14 Dec 1983 Transl into ENGLISH from Med (Moscow), 27 Jul 1983 p 3 Symp held in Moscow, sponsored by the International Union of Physiological Sciences Avail NTIS HC A07

Gravitational physiology and a wide range of problems for aerospace environments were discussed. The effect of gravitational loads and their changes on base mechanisms which determine the origin, development and sustaining of vital functions, gravitational effects in different systems of a living organism, physiological, biological and morphological manifestations of the effect of weightlessness and its modeling, and theoretical approaches and real means of correction of disruptions caused by changes in gravitational loads are outlined. E A K

**N84-14665# Army Research Inst of Environmental Medicine, Natick, Mass****EFFECTS OF ACUTE COLD EXPOSURE ON SUBMAXIMAL ENDURANCE PERFORMANCE**

J F PATTON and J A VOGEL 1983 20 p (AD-A132581, USARIEM-M-44/83) Avail NTIS HCA02/MFA01 CSCI 06S

The purposes of this study were to assess VO<sub>2</sub> max and submaximal endurance time to exhaustion (ET) during acute cold-air exposure. Eight male subjects (X age = 19.9 yrs) were alternately exposed in groups of four to chamber temperatures of +20 C and -20 C for 30 hrs each. A week was allowed between exposures. VO<sub>2</sub> max was measured using a mechanically braked cycle ergometer. ET was determined on the same ergometer using a 17 min - 3 min exercise - rest schedule until the subject was unable to maintain pedal rate. The data support the contention that aerobic capacity is not altered by cold exposure but suggest a marked decrease in submaximal endurance performance. It is postulated that this may result from a glycogen wasting effect due to increased catecholamine release in response to the cold. GRA

**N84-14666# Air Force Inst of Tech., Wright-Patterson AFB, Ohio****ELECTROMYOGRAPHIC ANALYSIS OF THE PERONEOUS LONGUS DURING BICYCLE ERGOMETRY ACROSS WORK LOAD AND PEDAL TYPE M.S. Thesis - North Carolina Univ.**

D L HOLT 1983 61 p (AD-A132550, AFIT/CI/NR-83-24T) Avail NTIS HCA04/MFA01 CSCI 06E

Lateral ankle injuries often result in residual disability. Increasing the endurance of the peroneous longus may reduce this problem.

Bicycle ergometry may increase the endurance of the peroneus longus, but the activity of the peroneus longus during pedaling is not known. The purpose of this study was to analyze the electromyographic (EMG) activity of the peroneus longus across work load (1, 2, and 3 Kp) and pedal type (standard and medial support only) during pedaling. The analysis included total, peak, and phasic EMG activity per cycle. EMG activity was monitored with bipolar surface electrodes arranged in a longitudinal configuration over the motor points. The pedaling cycle was monitored with a photo electric cell and the gait cycle was monitored with a heel switch. Gait data were used to normalize the pedaling data. Data from nineteen muscles were collected from eleven subjects, all adult males. Results indicated that (1) increasing work load significantly increases the total, peak, and phasic EMG activity, (2) modified pedals significantly increase the total, peak, and phasic EMG activity, (3) the interaction between work load and pedal type significantly increases the total and peak EMG activity, and (4) only pedaling with modified pedals results in EMG activity comparable to gait. GRA

**N84-14667#** California Univ, Los Angeles Dept. of Psychology  
**NEUROMAGNETIC LOCALIZATION OF TWO COMPONENTS OF THE TRANSIENT VISUAL EVOKED RESPONSE TO PATTERNED STIMULATION**

F RICHER, D S BARTH, and J BEATTY Apr 1983 11 p  
Presented at the 4th Intern Workshop on Biomagnetism, Rome, 14-16 Sep 1982

(Contract N00014-76-C-0616, NR PROJ 201-207)  
(AD-A132546, TR-32) Avail NTIS HCA02/MFA01 CSDL 06P

Corresponding electrical and magnetic components of the brain's visual evoked response at 120 and 180 ms poststimulus are examined. Results show that both magnetic components are localized in the superficial occipital cortex tangential to the scalp. The distribution of M120 suggests that the generators of the electrical and magnetic components are related, but the electrical field recorded is an elaborate modification of that produced by the source. Author

**N84-14668#** California Univ, Los Angeles Lab for Human Neurophysiology  
**MAGNETOENCEPHALOGRAPHY**

J BEATTY, F RICHER, and D S BARTH 1 Sep 1983 35 p  
Submitted for publication

(Contract N00014-76-C-0616)  
(AD-A132496, TR-30) Avail NTIS HCA03/MFA01 CSDL 06P

Under certain conditions the activity of large neurons within the brain may produce magnetic fields that are recordable at the scalp. Such recording has been termed magnetoencephalography, the magnetic counterpart of electroencephalography. In this paper, we describe some properties of brain magnetic activity and review the recent application of magnetoencephalography to the study of both normal human brain function and cases of cerebral pathology. GRA

**N84-14669#** Army Research Inst of Environmental Medicine, Natick, Mass

**AEROBIC FITNESS AND THE HYPOHYDRATION RESPONSE TO EXERCISE-HEAT STRESS**

B A CADARETTE, M N SAWKA, M M TONER, and K B PANDOLF Aug 1983 24 p

(Contract DA PROJ 3E1-62777-A-879)  
(AD-A132263, USARIEM-M-43/83) Avail NTIS HCA02/MFA01 CSDL 06S

This study examined the influence that aerobic fitness (V02 max) had on final heat rate (HR), final rectal temperature (Tre), and total body sweat rate (Msw) when subjects exercised while euhydrated and hypohydrated (-5.0% from baseline body weight). Eight male and six female subjects completed four exercise tests both before and after a 10-day heat acclimation program. The tests were a euhydration and a hypohydration exposure conducted in a comfortable (20 C, 40% rh) and in a hot-dry (49 C, 20% rh) environment. Significant differences were not generally found

between the genders for HR, Tre and Msw during the tests. In the comfortable environment, HR, Tre and Msw were not generally significantly correlated ( $P > 0.05$ ) with V02 max. In the hot-dry environment, Tre and V02 max were significantly correlated ( $r = 0.58$ ) when euhydrated before acclimation. Also, HR was significantly related to V02 max before acclimation when eu- ( $r = -0.61$ ) and hypohydrated ( $r = -0.60$ ) as well as after acclimation when eu- ( $r = -0.57$ ) and hypohydrated ( $r = -0.67$ ). These data indicate that when euhydrated in the heat, aerobic fitness provides cardiovascular and thermoregulatory benefits. However, when hypohydrated in the heat, cardiovascular benefits are present for fit subjects both before and after acclimation, but thermoregulatory benefits are not associated with fitness. GRA

**N84-14670#** Air Force Inst of Tech, Wright-Patterson AFB, Ohio

**CONTROL DEVICE MANIPULATIVE BEHAVIOR, AROUSAL AND PERFORMANCE DURING A COMPENSATORY TRACKING TASK**  
**M.S. Thesis - New Mexico State Univ.**

H. M ACOSTA Dec 1980 97 p  
(AD-A133921, AFIT/CI/NR-80-83T) Avail NTIS HCA05/MFA01 CSDL 06D

This study examined the relationships between control activity, performance and arousal. Experimental non-task load (arousal) manipulations failed to generate significant performance effects, but did reliably affect at least one of three control-activity measures employed, namely, integrated absolute control displacement, IACD. The results offer support for a progression hypothesis. This hypothesis asserts that trends in control activity demonstrated at any given level of performance during skill development are paralleled by trends exhibited as arousal or, at least, non-task stimulation increases. Since performance failed to demonstrate a decrement, a proposed set of related regression hypotheses could not be tested. Author (GRA)

**N84-14671#** Texas Univ, Austin Dept of Chemical Engineering

**MATHEMATICAL SIMULATION OF DIVER PERFORMANCE** Final Report, 1 Jul. 1976 - 31 Dec. 1982

E H WISSLER 31 Aug 1982 13 p

(Contract N00014-76-C-0953)  
(AD-A133844) Avail NTIS HCA02/MFA01 CSDL 06S

This report summarizes the work accomplished during the six years covered by this contract. A mathematical model of the human thermal system was developed, validated for accuracy under conditions typically encountered in Navy diving operations, and applied to several problems of current interest. The following problems were analyzed: (1) prediction of the performance of a new passive diver thermal protection system developed at NCSC, (2) analysis of the lost bell problem of saturation diving, (3) analysis of heat stress in hyperbaric environments, and (4) prediction of survival time for various accidents involving immersion in cold water. Author (GRA)

**N84-14672#** Aerospace Medical Research Labs, Wright-Patterson AFB, Ohio Toxic Hazards Div

**BIBLIOGRAPHY OF RESEARCH REPORTS AND PUBLICATIONS ISSUED BY THE TOXIC HAZARDS DIVISION, 1957-1982**

L. S EVANS, comp, S A MOYER, comp, and J A MOORE Aug 1983 46 p

(Contract AF PROJ 6302)  
(AD-A133637, AFAMRL-TR-83-068) Avail NTIS HCA03/MFA01 CSDL 06T

The physiological effects of toxic hazards on animals and plant life, the toxic effect of rocket propellants upon the environment; and the environment within spacecraft cabins and its effects on animals were studied. B G

## 52 AEROSPACE MEDICINE

**N84-14673#** Harvard Medical School, Boston, Mass Dept of Physiology and Biophysics  
**SYMPOSIUM ON MATHEMATICAL MODELING OF CIRCADIAN SYSTEMS Final Scientific Report, 1 May 1981 - 30 Apr. 1982**  
M C MOORE-EDE May 1982 31 p  
(Contract AF-AFOSR-0133-81; AF PROJ 2312)  
(AD-A133636, AFOSR-83-0851TR) Avail NTIS HCA03/MFA01 CSCL 12A

This is the Final Scientific Report on a Satellite Symposium on the mathematical modeling of circadian systems which was held on June 21, 1981 in conjunction with the Annual Meeting of the Association for the Psychophysiological Study of Sleep in Cape Cod, Massachusetts. The purpose of the satellite symposium was to present and critically review recently developed mathematical models of the circadian timing system, with particular emphasis on human sleep-wake organization, as designed by various investigators from both the United States and abroad who would be invited to participate. GRA

**N84-14674#** Naval Submarine Medical Research Lab, Groton, Conn  
**THE STABILITY OF VISUAL FIELD MEASURES WITH REPEATED TESTING Interim Report**  
C. L. SCHLICHTING and R. RODRIGUEZ 1 Sep 1983 10 p  
(Contract MR00001)  
(AD-A132704, NSMRL-1008) Avail NTIS HCA02/MFA01 CSCL 14B

Vitamin supplementation and deficiencies may affect the size of the area in which the human eye can see (visual field). Before using this measure, however, it is important to determine how reliable visual field testing is over several sessions. The size of the visual field was tested in ten subjects on five different days. Subjects with normal vision showed approximately two degrees variation in visual field extent over the sessions. This suggests that the measure can be incorporated in the test protocol designed to study the effect of vitamin supplementation during submarine patrols. Author (GRA)

**N84-14675#** Bolt, Beranek, and Newman, Inc., Canoga Park, Calif  
**THE DETECTABILITY OF REPETITIVE, PERIODIC IMPULSES Final Report, 1 Feb. 1980 - 31 Jan. 1983**  
R. HORONJEFF, S. FIDELL, and D. GREEN May 1983 61 p  
(Contract DAAG29-80-C-0057)  
(AD-A132744, BBN-5314, ARO-16729 5-LS) Avail NTIS HCA04/MFA01 CSCL 06P

Concern for predicting aural detectability of complex natural sounds has generally focused on steady state tonal and broadband signals. Procedures for calculating detectability of such signals are reasonably well established and validated. Large errors of prediction may occur, however, when these procedures are applied to other classes of signals, such as high crest factor, short duration, impulsive wavetrains. The experimentation described here was intended to support analyses of detection performance that could lead to general quantitative procedures for predicting the audibility of repetitive, periodic impulsive signals. Three separate studies were conducted using similar procedures. The first study quantified the detectability of individual impulses. The second study was directed toward the detectability of multiple impulses of varying periodic repetition rates. The third study explored hypotheses about detection strategies suitable for modelling the audibility of repetitive impulsive wavetrains. GRA

**N84-14676#** National Academy of Sciences - National Research Council, Washington, D. C. Committee on Behavioral and Social Aspects of Energy Consumption and Production  
**ENERGY USE: THE HUMAN DIMENSION**  
P. STERN, ed and E. ARONSON, ed Mar 1983 347 p  
(DE84-001405, DOE/NBM-4001405) Avail NTIS HC A15/MF A01

The nature and determinants of energy consumption, prevention, preparation, and response for energy emergencies and plans for meeting energy needs at the local level are considered.

Factors which influence individual and social behavior were analyzed incorporate the human dimension into energy policy. Energy aspects in modern society encompass simultaneously a commodity, an ecological resource, a social necessity, and a collection of strategic materials, but citizens view these one at a time. The potential for improved energy efficiency use is reviewed. DOE

**N84-14677#** Fondazione Ugo Bordoni, Rome (Italy)  
**MODEL OF THE BEHAVIOR OF THE HUMAN VISUAL SYSTEM FOR THE PERCEPTION OF CONTOUR ELEMENTS [MODELLO DI COMPORTAMENTO DEL SISTEMA VISIVO UMANO PER LA PERCEZIONE DEGLI ELEMENTI DI CONTORNO]**  
R. CUSANI (Rome Univ), G. DIBLASIO (Rome Univ), A. ORLANDO, and F. PAPA Dec 1982 42 p refs In ITALIAN (FUB-44-1982) Avail NTIS HC A03/MF A01

The visual system is modelled as a receiver formed by an element for the processing of the signal (the retina), followed by a transmission channel (optical nerve) and a decision system (the brain cortex) where the boundaries and the lines of the image are recognized. The assumed mechanism, suggested by decision theory, is that of a maximum likelihood estimate in which after the identification of the presence of a contour element a procedure of parameter determination follows. Experimental physiological results are used to determine the numerical parameters which characterize the model. The agreement between model and experiment suggests that the human system works also with a preliminary acquisition followed by a fine data acquisition with dynamic triggering. The required presence of filters which limits the number of different structures that may be identified by the human system suggests the possibility of reduction of the redundancy in the transmission or recording of images. Author (ESA)

**N84-14678#** Jefferson Medical Coll., Philadelphia, Pa  
**ASSESSMENT OF ULTRASONIC B-SCAN IMAGING FOR DETECTION AND QUANTIFICATION OF ATHEROSCLEROTIC LESIONS IN HUMAN CAROTID AND ILLIOFEMORAL ARTERIES AND IN ARTERIES OF ANIMALS Annual Report, Apr. 1982 - Apr. 1983**  
B. B. GOLDBERG May 1983 68 p  
(Contract N01-HV-2912)  
(PB83-261123, NIH-N01-HV-2912) Avail NTIS HC A04/MF A01 CSCL 06L

The B-Scan Assessment program presents a new challenge for ultrasound in determining its ability to identify and quantify atherosclerotic plaques in the carotid and femoral arteries. As in many modalities of diagnostic implementation in medicine, the state of the art is enhanced by the trial and error experience and repetition. Correlation of B-Scan with arteriogram of the two vessels concerned has demonstrated that time and education could provide essentially a noninvasive workup of a stroke-prone patient. Similarly, patients suffering from claudication clinically arising from diseased femoral arteries might instead be scheduled for a non-invasive study, than initially the invasive arteriogram. GRA

**N84-14679#** Applied Physics Lab, Johns Hopkins Univ., Laurel, Md  
**HUMAN REACTIONS TO ELF ELECTRIC AND MAGNETIC FIELDS: AN ANNOTATED BIBLIOGRAPHY OF CURRENT LITERATURE, 3RD EDITION Final Report**  
J. P. REILLY Jul 1983 95 p  
(PB83-259648, PPSP/JHU/PPSE-T-27) Avail NTIS HC A05/MF A01 CSCL 06F

The annotated bibliography lists current literature (since 1960) which applies to human reactions to electric and magnetic fields from 10 Hz to 100 Hz, with an emphasis on power frequency fields. This includes direct experimental work with humans, epidemiological studies, work which uses animal studies to draw inferences about human reactions, studies concerning human dosimetry, and works which discuss means for human protection. This volume is an updated version of an earlier bibliography, first

published in July 1982, and revised in a second edition in July 1982  
Author (GRA)

**N84-14680#** Health Effects Research Lab, Research Triangle Park, N C

**BIOLOGICAL EFFECTS OF RADIOFREQUENCY RADIATION: REVIEW DRAFT, PARTS 1, 2 AND 3**

D F CAHILL and J A ELDER Jun 1983 611 p refs  
(PB83-262550, EPA-600/8-83-026A-PT-1/2/3) Avail NTIS HC A99/MF A01 CSCL 06R

The document presents a critical and comprehensive review of the available literature on the biological effects of radiofrequency (RF) radiation through 1980. The objective is to determine whether the existing data base can contribute to the formulation of RF radiation exposure guidance for the general public

Author (GRA)

**N84-14681** North Carolina Univ., Chapel Hill  
**OXYGEN INSUFFICIENCY AND ENERGY FAILURE IN BRAIN: UNCOUPLING OF OXIDATIVE PHOSPHORYLATION AT LOW OXYGEN CONCENTRATION Ph.D. Thesis**

R D PEARLSTEIN 1983 106 p  
Avail Univ Microfilms Order No DA8316648

The stoichiometry of oxidative phosphorylation at low oxygen concentration 5 micrometers has been measured in suspension of isolated mitochondria Employing a steady-state technique in which respiration rate was experimentally controlled by either oxygen or substrate limitation, flux-dependent variation in the phosphorylation efficiency (P/O ratio) of stimulated mitochondrial respiration was evaluated P/O ratio remained constant over a wide range of respiration rates in mitochondria limited by substrate availability In contrast, oxygen-limited mitochondria demonstrated a continuous decline in P/O ratio as respiration was increasingly restricted This unique characteristic is proposed to arise as a consequence of the accumulation of electron in respiratory chain cytochromes In several experimental settings in which variation in the stoichiometry of oxidative phosphorylation was demonstrated, intra-mitochondrial electron density was the only variable uniformly correlating with phosphorylation efficiency Dissert Abstr

**N84-15763\*** National Aeronautics and Space Administration, Washington, D C

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 252)**

1983 69 p  
(NASA-SP-7011(252), NAS 1 12/7 7011(252)) Avail NTIS HC A02/MF A01 CSCL 06E

This bibliography lists 204 reports, articles and other documents introduced into the NASA scientific and technical information system in November 1983

Author

**N84-15764\*** National Aeronautics and Space Administration Langley Research Center, Hampton, Va

**LOW X-RAY ABSORPTION ANEURISM CLIPS Patent Application**

R. M BAUCOM, inventor (to NASA) 10 Feb 1983 10 p  
(NASA-CASE-LAR-12650-2, US-PATENT-APPL-SN-465363)  
Avail NTIS HC A02/MF A01 CSCL 06C

An X-ray transparent and biological inert medical clip for treating aneurysms and the like is disclosed as well as a process for its production A graphite reinforced composite film is molded into a unitary structure having a pair of hourglass like cavities which are hinged together with a pair of jaws for grasping the aneurysm extending from the wall of one cavity A silicone rubber pellet is disposed in the other cavity to exert a spring force through the hinge area to normally bias the jaws into contact with each other

NASA

**N84-15765#** Tufts Univ., Boston, Mass Musculo-Skeletal Research Group

**STRESS FRACTURES: THE REMODELLING RESPONSE TO EXCESSIVE REPETITIVE LOADING**

C. T RUBIN, J M HARRIS, B H JONES, H. B ERNST, and L E LANYON 6 Jul 1983 7 p  
(Contract DAAK60-83-C-0031)

(AD-A130881) Avail NTIS HC A02/MF A01 CSCL 06E

The occurrence of stress fractures indicates a failure to maintain an adequate match between bones structure and their functional requirement. Stress fractures occur both in well-trained athletes pushing for the limits of their performance, and in poorly-trained people, particularly women, following an abrupt change or increase in the level of their physical activity The conventional view of the etiology of the training up type of stress fracture is that the remodelling processes are incapable of completing the necessary structural alterations before continued loading causes failure due to fatigue in the bone material GRA

**N84-15766#** Colorado Univ., Denver Cardiovascular Pulmonary Research Lab

**INCREASED METABOLISM AND DEAD SPACE AS COMPONENTS OF VENTILATION AT HIGH ALTITUDE**

S Y HUANG, J K ALEXANDER (Baylor Univ.), R F GROVER, J T MAHER (Army Research Inst of Environmental Medicine), R E MCCULLOUGH, L G MOORE, J V WEIL, J B SAMPSON, and J T REEVES (Army Research Inst of Environmental Medicine) 12 Jul 1983 21 p refs

(Contract DAMD17-81-C-1057, NIH-HL-14985, DA PROJ 3E1-162777-A-879)

(AD-A130827) Avail NTIS HC A02/MF A01 CSCL 06S

Ventilatory acclimatization to high altitude results in alveolar hyperventilation, which is an increase in alveolar ventilation per unit of carbon dioxide production and is associated with a fall in the PCO<sub>2</sub>. A measurement frequently made during acclimatization to high altitude is the total volume of air expired per minute, the minute ventilation. However, the relation of total to alveolar ventilation and the influence of CO<sub>2</sub> production on the latter at high altitude is unclear. We sought to determine the contribution of changes in metabolism and in dead space ventilation to the increase in minute ventilation observed with ascent and during exposure to high altitude. In 12 healthy male subjects taken from Denver, Colorado (1600 M) to Pikes Peak, Colorado (4300 M) for 5 days, resting minute ventilation increased from low to high altitude (+35% by day 5) and arterialized venous PCO<sub>2</sub> fell. Resting metabolic rate (VCO<sub>2</sub>) increased 16% by day 5 and could account for approximately half of the increase in minute ventilation. The increases in ventilation on days 1, 2 and 4 were positively correlated with increased CO<sub>2</sub> production, they were not correlated with arterial oxygen saturation on any day. During exercise at high altitude, minute ventilation rose above low altitude values but less than 10% of the increase in ventilation could be attributed to increased CO<sub>2</sub> production. Dead space ventilation at high altitude was the same as at low altitude in resting subjects GRA

**N84-15767#** Army Research Inst of Environmental Medicine, Natick, Mass

**THE EFFECTS OF DEHYDRATION ON PERIPHERAL COOLING**

D E ROBERTS, J J BERBERICH, and R E DROEGE 1983 27 p refs

(AD-A130838, USARIEM-M36/83) Avail NTIS HC A03/MF A01 CSCL 06S

Ten men were dehydrated by voluntary restriction of fluid intake and by mild exercise over a 2-1/2 day period (body weight loss. 4.6%). Body weight returned to -16% and -0.3% of their starting weight 10 to 20 hours after rehydration, respectively, suggesting the weight loss was fluid loss. Measures of blood and urine constituents also were indicative of dehydration. These 10 experimental subjects experienced a standard cold test prior to and after dehydration and after rehydration. The standard cold test consisted of sitting in a cold chamber (0 c) dressed in cold weather clothing with right hand bare for 2 hours. The fingers, but not the back of the hand, of the experimentals were significantly

colder (P 05) following dehydration and were slightly warmer following initial rehydration. A group of 10 control subjects tested under identical conditions, but hydrated at all times, showed no changes  
Author (GRA)

**N84-15768#** Colorado Univ, Denver Cardiovascular Pulmonary Research Lab

**VARIABLE INHIBITION BY FALLING CO<sub>2</sub> OF HYPOXIC VENTILATORY RESPONSE IN MAN**

L G MOORE, S Y HUANG, R E MCCULLOUGH, J B SAMPSON (Army Research Inst of Environmental Medicine), J T MAHER (Army Research Inst of Environmental Medicine), J V WEIL, R F GROVER, J K ALEXANDER (Baylor College of Medicine), and J T REEVES 21 Jun 1983 17 p refs

(Contract DAMD17-81-C-1057, NIH-HL-14985, DA PROJ

3E1-16777-A-879)

(AD-A130658, USARIEM-M32/83) Avail NTIS HC A02/MF A01 CSCI 06S

Acute hypoxia stimulates an increase in ventilation but the resulting hypocapnia limits the magnitude of the increase. Thus, the hypoxic ventilatory response is usually measured during isocapnia, but this may not reflect events at high altitude. Possibly the degree of inhibition by hypocapnia might depend on individual ventilatory response to CO<sub>2</sub> and thus vary between persons. If so, it might be useful to compare between individuals an isocapnic hypoxic ventilatory response (PACO<sub>2</sub> maintained by CO<sub>2</sub> addition) with a response in which CO<sub>2</sub> was not added and the PACO<sub>2</sub> fell to a variable extent (poikilocapnic hypoxia). We found in 14 healthy persons that, although the poikilocapnic hypoxic ventilatory response positively correlated with the isocapnic hypoxic response, the relation was improved by a multiple regression which included the negative association with the normoxic hypercapnic response. Thus the magnitude of the difference between the isocapnic and the poikilocapnic hypoxic responses related to the hypercapnic response (p less than 0.01). In those subjects with small hypercapnic responses, a falling CO<sub>2</sub> during hypoxia had little depressant effect on the hypoxic ventilatory responses. GRA

**N84-15769#** Army Research Inst of Environmental Medicine, Natick, Mass

**DIFFERENTIATED RATINGS OF PERCEIVED EXERTION AND SELECTED PHYSIOLOGICAL RESPONSES DURING PROLONGED UPPER AND LOWER BODY EXERCISE**

K B PANDOLF, D S BILLINGS, L L DROLET, N A PIMENTAL, and M N SAWKA Oct 1983 26 p

(Contract DA PROJ 3E1-62777-A-879)

(AD-A134086, USARIEM-M-2/84) Avail NTIS HCA03/MFA01 CSCI 06S

This study examined whether prolonged exercise employing upper or lower body muscle groups led to significant alterations in differentiated ratings of perceived exertion (diff RPE). Nine volunteer males performed 60 min of arm crank (AC) and cycle (CY) exercise at similar absolute (ABS) and at similar relative (REL) exercise intensities. There were no significant differences (P > 0.05) between AC and CY for oxygen uptake (VO<sub>2</sub>) during the ABS tests (about 1.60 l/min) or in percent ergometer specific peak VO<sub>2</sub> during the REL tests (about 60%). Diff RPE included local RPE (muscle and joint exertion), central RPE (ventilatory and circulatory exertion), and overall RPE. During the ABS tests, the final means for all three diff RPE were lower (P < 0.05) for CY than AC exercise. No differences (P > 0.05) were found during the REL tests between AC and CY exercise for any of the diff RPE. Local RPE was generally higher than central RPE. Selected physiological responses accounted for more total variance in all diff RPE for AC than CY exercise. These data indicate that diff RPE may be more closely related to relative exercise intensity, and perceptual cues may be more readily monitored from smaller muscle masses such as the upper body. GRA

**N84-15770#** SRI International Corp, Menlo Park, Calif  
**SPATIOTEMPORAL CHARACTERISTICS OF VISUAL LOCALIZATION Annual Technical Report, 1 Jun. 1982 - 31 May 1983**

C A BURBECK 15 Jul 1983 15 p

(Contract F49620-82-K-0024, AF PROJ 2313)

(AD-A133952, AFOSR-83-0832TR) Avail NTIS HCA02/MFA01 CSCI 05J

A computer-based display system has been designed and built enabling the investigation of the processes underlying spatial localization. Among the results obtained in the past year with the use of this device are: (a) Eye movements play a significant role in spatial localization that is not limited to positioning the stimulus array optimally on the retina. (b) Neither retinal image drift nor abrupt movement of the retinal image is sufficient to restore normal performance on a localization task when the effects of eye movements on retinal image position are eliminated. (c) Preliminary data indicate that localization is a very slow process, much slower than form detection. In related work it has been shown that for some simple forms (sine wave gratings) the relative orientation of the stimuli does not affect ability to detect small differences in their sizes and conversely a difference in size between two stimuli does not affect ability to detect a small difference in their orientations. Further it has been found that the detection of small differences in size between two objects is masked strongly by stimuli consisting of fine lines but not by stimuli consisting of broader lines (high and low spatial frequency gratings respectively). It has also been found that eye movements are essential to the discrimination of objects on the basis of hue except in the yellow region of the spectrum. GRA

**N84-15771#** Saint Louis Univ, Mo School of Medicine  
**EXPERIMENTS ON FACTORS THAT INFLUENCE MUSCULAR FUNCTION IN MAN Final Report, Jul. 1980 - Sep. 1982**

A R LIND, C A WILLIAMS, and M D HOFFMAN 25 May 1983 79 p

(Contract AF-AFOSR-0221-80, AF PROJ 2312)

(AD-A133928, AFOSR-83-0859TR) Avail NTIS HCA05/MFA01 CSCI 06P

Research was concerned with muscular function and fatigue. The systemic cardiovascular responses are much the same when the contractions result in muscular fatigue, at which time the mean blood pressure is the same as it is in response to sustained isometric contractions. All the available evidence points to the same mechanisms being involved, centering around the reflex of chemical origin in active muscles. There appears, however, to be considerable differences in the local control of blood vessels when isometric contractions are pursued to fatigue on a continuous or on an intermittent basis. In the present experiments we have shown that the constriction is neural in origin and that metabolites which normally inhibit that constriction are unable to migrate through the interstitial space to larger arterioles not in the direct vicinity of the contracting muscles. The performance of very short bouts of rhythmic exercise can result in dramatic reductions of isometric endurance and, to some extent, isometric strength. The functional consequences are obvious jobs calling for either isometric strength or endurance can be seriously impaired by previous rhythmic exercise. The causes are only partially disclosed by our experiments. GRA

**N84-15772#** University of the Pacific, Forest Grove, Oreg Coll of Optometry

**EVALUATION OF FACTORS PRODUCING VISUAL EVOKED RESPONSE VARIABILITY Final Report, 1 Jun. 1982 - 31 May 1983**

R L YOLTON Jun 1983 41 p

(Contract AF-AFOSR-0160-82, AF PROJ 2313)

(AD-A133917, AFOSR-83-0854TR) Avail NTIS HCA03/MFA01 CSCI 06P

Ten steady-state visual evoked responses (VERs) were recorded from each of 47 normal, adult subjects. For each subject, the mean and standard deviation for the ten VER amplitudes were calculated and used to determine amplitude variability. While some



subjects produced extremely reliable VERs, data from the majority showed a considerable degree of variability. A number of factors including trend, noise, attention, binocularity, accommodation, eye movements, artifacts and electrode placement were evaluated to determine their relative contributions to this variability. Noise and trend factors produced a large proportion of the variability (62%) while the other factors were found to be relatively insignificant. Author (GRA)

**N84-15773#** New York Univ., New York  
**PERCEPTION OF HIGHER DERIVATIVES OF VISUAL MOTION**  
 Interim Scientific Report, 1 Jan. - 31 Dec. 1982  
 L KAUFMAN and S J WILLIAMSON 23 Apr. 1983 5 p  
 (Contract AF-AFOSR-0050-82, AF PROJ 2313)  
 (AD-A133908; AFOSR-83-0831TR) Avail NTIS HCA02/MFA01  
 CSCL 05J

This document describes a basic experiment involving the sensitivity of the visual system to the modulation of speed of gratings moving in one direction across the visual field. The gratings were of different spatial frequencies, had different average speeds, and the speeds were modulated at different temporal frequencies. This was done in two stages using the method of adjustment. We also implemented a very sophisticated computer program allowing us to use a two-interval forced-choice paradigm in the context of a modified staircase method for accurately measuring thresholds for change of speed and how they are affected by the foregoing parameters, and others as well. Findings indicated that for all modulation frequencies, sensitivity to acceleration was uniform across all spatial frequencies at low average speeds. As average speed increased, there was an increasing monotonic increase in sensitivity for spatial frequency. Acceleration is proportional to modulation frequency as well as to the amplitude of the modulation of speed. GRA

**N84-15774#** Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md  
**NEUROBEHAVIORAL EFFECTS OF CARBON MONOXIDE (CO) EXPOSURE IN HUMANS PROTOCOL 1 Final Report, 1981 - 1982**  
 V A BENIGNUS, K E MULLER, C N BARTON, J D PRAH, and L L BENIGNUS Jan 1983 80 p  
 (AD-A133891) Avail NTIS HCA05/MFA01 CSCL 05J

The neural and behavioral effects of acute low level carbon monoxide exposure are not well known but have been reported to produce sensory and vigilance deficits. Stage one of this research program is to establish a reliable paradigm for the measurement of CO effects. During stage two concentration-effects functions are to be established. Stage three is concerned with the evaluation of the concentration effects functions in an actual field (Army training) setting. A total of 92 subjects were used in this double-blind study, 47 air-exposed controls and 45 subjects exposed to 200 ppm CO for 15 hours. In the confirmatory analyses CO did not affect any behavioral measure. Alpha-band EEG power may have been affected by this level and duration of CO exposure. Although the trends were subjectively reliable for each of two tasks on both EEG sites in both halves of the sample and in the total group, the effect did not reach statistical significance. Vigilance, alpha-band EEG power and theta-band EEG power had significant trends across time. Apparently unless CO has some non-hypoxic effect, no consistent vigilance decrement should occur until COHb reaches about 13%. There might be specific but minor effects as low as 7% COHb. Since these figures were based upon extrapolations, they are subject to considerable error. GRA

**N84-15775#** Virginia Mason Research Center, Seattle, Wash  
**INTERACTION OF ANTI-G MEASURES AND CHEST WALL MECHANICS IN DETERMINING GAS EXCHANGE** Annual Progress Report, 1 Apr. 1982 - 31 Mar. 1983  
 H I MODELL May 1983 40 p  
 (Contract F49620-81-C-0055, AF PROJ 2312)  
 (AD-A133740, AFOSR-83-0808TR) Avail NTIS HCA03/MFA01  
 CSCL 06S

Efforts during this reporting period have been directed in three areas: (1) Examination of regional intrapleural pressure changes during +Gz stress in the pig, (2) Development of an inexpensive assist/control, volume limited animal ventilator, and (3) Determining the influence of chest wall motion on gas exchange during mechanical ventilation in dogs. Studies assessing regional intrapleural pressure changes during +Gz stress in the dog were repeated in similar sized pigs to determine the role of chest wall mechanics in determining these changes. When the G-suit abdominal bladder was used, increases in regional intrapleural pressure greater than those seen in analogous dog experiments were observed. These results imply that, as the chest wall becomes less compliant, the degree of lung compression attributable to +Gz stress without G-suit application should diminish. In another series of experiments, gas exchange during assisted and controlled ventilation were compared in an attempt to ascertain whether an active effort by chest wall muscles coordinated with inspiration can influence gas exchange. The data obtained indicate that an inspiratory muscular effort enhances gas exchange. Measured gas exchange parameters suggest that this enhancement is the result of a redistribution of perfusion rather than a redistribution of ventilation. GRA

**N84-15776#** California Univ., Los Angeles Mental Retardation Research Center  
**NEURONAL ADAPTIVE MECHANISMS UNDERLYING INTELLIGENT INFORMATION PROCESSING** Final Report  
 C D WOODY May 1983 82 p  
 (Contract AF-AFOSR-0179-81, AF PROJ 2312)  
 (AD-A133694, AFOSR-83-0834TR) Avail NTIS HCA05/MFA01  
 CSCL 05J

Acceleration of the rate of learning of a conditioned facial movement was accomplished by adding electrical stimulation of the hypothalamic region of the brain to presentations of conventional conditioned and unconditioned stimuli, confirming earlier Soviet observations of a comparable effect by such stimulation. The learning that resulted was both associative and discriminative. That is, learning was induced by a specific stimulus combination, the code depending on the order and interval of presentations of two different stimuli. The learned response was then elicitable by a specific stimulus combination, the code depending on the order and specific input signal. Research indicates that the pattern of cortical neuronal activity produced by hypothalamic stimulation predicts loci of hypothalamic stimulation that, when, stimulated, will succeed in accelerating learning. Present studies are directed toward establishment of whether the hypothalamic stimulation responsible for acceleration of learning is punishing or rewarding. This may, however, be of less consequence in understanding what is going on than would specifying the coded molecular interactions that occur between the chemical(s) released by hypothalamic stimulation and other chemicals capable of modifying the transfer properties of the nerve cell. It is these interactions that are thought to be primary in controlling the potentiation of learning. Author (GRA)



**N84-15777#** Naval Submarine Medical Research Lab, Groton, Conn

**PROCEEDINGS OF THE 3RD TRIPARTITE CONFERENCE ON SUBMARINE MEDICINE: FRANCE, UNITED KINGDOM AND THE UNITED STATES**

D R KNIGHT and K R BOND 1 Jun 1983 190 p Conf held 9-10 May 1983

(AD-A133150, NSMRL-SR-83-1) Avail NTIS HCA09/MFA01 CSDL 06S

The proceedings of the third tripartite conference on submarine medicine are reported. Five sessions were included in the 2-day conference, namely, (1) (STANAG 1206) Maximum Concentrations of Toxic Substances during Operational Conditions, (2) (STANAG 1184) Emergency Conditions at 1 ATA--Maximum Concentrations in Conventional Submarines, (3) The Toxicology of Atmosphere Contaminants in Submarines, (4) Escape or Rescue Distressed Submarines, and (5) Effects of Lifestyles aboard Submarines on Human Performance and Function. Participants included scientists from the three nations--France, the United Kingdom and the United States. GRA

**N84-15778#** Federal Aviation Administration, Washington, D C Office of Aviation Medicine.

**INHALATION TOXICOLOGY. 3: EVALUATION OF THERMAL DEGRADATION PRODUCTS FROM AIRCRAFT AND AUTOMOBILE ENGINE OILS, AIRCRAFT HYDRAULIC FLUID, AND MINERAL OIL**

C R CRANE, D C SANDERS, B R ENDECOTT, and J K ABBOTT Apr 1983 19 p

(AD-A133221, FAA-AM-83-12) Avail NTIS HCA02/MFA01 CSDL 06T

A malfunctioning seal in the gear-reduction box of a turboprop aircraft engine could allow oil to enter the turbine's compressor section, which is the source of bleed air used to pressurize the cabin. Oil, or its degradation products, could have a deleterious effect on crew and passengers. A series of tests sponsored by the National Transportation Safety Board had examined the possibility that contaminated bleed air might contain toxic products identifiable by chemical analysis, but none of the gases for which they analyzed were present in toxic concentrations. However, the approach did not eliminate the possible presence of an additional component with significant animal toxicity. The research reported here examined the toxicity of thermal degradation products from aircraft lubricating oils and some related products. Rats were exposed to smoke from these products and relative toxicity evaluated in terms of time-to-incapacitation and time-to-death. The carbon monoxide (CO) content of the smoke was measured and this information, in conjunction with the animal response times, was the basis for concluding that the decomposition of these oils did not produce any chemical species, other than CO, in quantities sufficient to contribute to the total toxicity. GRA

**N84-15779#** Ohio State Univ, Columbus Research Foundation

**OPTICAL FLOW AND TEXTURE VARIABLES USEFUL IN SIMULATING SELF MOTION (2) Final Technical Report, 1 Feb. 1982 - 31 Mar. 1983**

D H OWEN Jun 1983 143 p

(Contract AF-AFOSR-0078-81, AF PROJ 2313)

(AD-A133597, AFOSR-83-0807TR) Avail NTIS HCA07/MFA01 CSDL 06P

This report outlines a program of research applying ecological optics to the study of visual information useful for detecting and guiding self motion during flight. Techniques are presented for isolating optical sources of information by controlling simulated flight path and speed variables in conjunction with ground surface texture variables. Problems encountered in the design of experiments using higher-order ratios exhibiting constrained linkages are discussed, and several solutions are suggested. A case is made for the necessity of considering the entire perception-(control) action cycle in the study of self-motion sensitivity, and implications of ecological optics experiments for the understanding of smart information-specifying visual system

mechanisms are discussed. Three experiments are presented testing the usefulness of optical variables and invariants for detecting changes in speed and altitude. Our findings to date provide a basis for the development of tests to evaluate candidates for flight training, the simulators with which pilots are trained, and improvement in sensitivity with training. In addition, our approach provides a sound empirical foundation from which to begin interactive experiments in which pilots control, rather than simply react to, the variables and invariants of optical stimulation. GRA

**N84-15780#** Army Research Inst of Environmental Medicine, Natick, Mass

**HEAT EXCHANGE FOLLOWING ATROPINE INJECTION BEFORE AND AFTER HEAT ACCLIMATION**

M A KOLKA, W L HOLDEN, and R R GONZALEZ Aug 1983 16 p

(Contract DA PROJ 3M1-62734-A-875)

(AD-A132618, USARIEM-M45/83) Avail NTIS HCA02/MFA01 CSDL 06O

The effect of saline and atropine injection (2 mg, im) on eight healthy, male subjects before and after heat acclimation was studied while each subject did treadmill walking in a hot-dry environment. Partitioned calorimetric analysis was done for the periods in which maximum sweat inhibition occurred (30 min). Mean skin temperature ( $T_{sk}$ ), rectal temperature and heart rate was continuously observed. Evaporative loss from the skin was calculated by changes in body weight (Sauter balance), heat transfer coefficients were defined by Nishi equations. A prediction of sweat inhibition based on an analysis of heat storage and its effect on a theoretical temperature which can be graphed on a psychrometric chart, was developed. A rational effective temperature ( $ET^*$ ) defined as the  $T_{sub 0}$  at the intersection of the 50% rh which encompasses total heat exchange was used to compare the effects of atropine before and after heat acclimation. The results show that heat acclimation reduced  $ET^*$  by some 2.5 C when compared to the unacclimated state after atropine injection. Thus, heat acclimation reduces the hazards of heat stroke caused by exercise in the heat with atropine injection. GRA

**N84-15781#** Federal Aviation Administration, Washington, D C Office of Aviation Medicine

**COLOR PERCEPTION AND ATC JOB PERFORMANCE**

E W PICKREL and J J CONVEY Jul 1983 20 p

(AD-A132649, FAA-AM-83-11) Avail NTIS HCA02/MFA01 CSDL 06N

Current OMP policy and guidance requires demonstrated job-relatedness and reasonable accommodation in the application of physical qualifications. The OPM has accomplished an analysis of the Air Traffic Control Specialist (ATCS) series and recommended development of functional color vision tests 'to reflect as closely as possible the functional color vision requirements of the specialty. If the Pseudoisochromatic plate (PIP) test is retained for prescreening to identify applicants for whom followup functional performance testing or reasonable accommodation is necessary, its use also must be standardized.' This research is directed toward accomplishment of those recommendations. Standard Pseudoisochromatic (PIP) plate test was validated against performance of ATCS tasks, and it demonstrated job relatedness and reasonable accommodation for application of physical qualification standards. A functional color vision test was created, but further development and validation would be needed before its operational use, and procurement would be very costly as compared to the standard PIP tests that are readily available to medical examiners. GRA

**N84-15782#** Cornell Univ, Ithaca, N Y School of Applied and Engineering Physics  
**BASIC VISION EVENTS Phase Report, Aug. 1981 - Aug. 1982**  
 A. LEWIS 1 Aug 1982 17 p  
 (Contract N62269-81-C-0744)  
 (AD-A132746, NADC-83050-60) Avail NTIS HCA02/MFA01  
 CSCL 06P

This investigation studied basic visual events in three particular areas. First, additional physical explanations for visual sensitivity at 589 nm have been obtained which suggests that there may be other monochromatic wavelengths with high visual sensitivity. Second, new femtosecond lasers have been applied to elucidate new, unresolved primary processes in visual transduction. Third, fundamental mechanisms in a unique, rapidly adjustable light filter based on molecules used in visual systems have been studied.

GRA

**N84-15783#** Cornell Univ, Ithaca, N Y. School of Applied and Engineering Physics  
**PRIMARY EVENTS IN VISION - INVESTIGATION OF BASIC EYE RESPONSES Phase Report, Jun. 1982 - Jun. 1983**  
 A. LEWIS 30 Jun 1983 13 p  
 (Contract N62269-82-M-3270)  
 (AD-A132747, NADC-83051-60) Avail NTIS HCA02/MFA01  
 CSCL 06P

The focus of this investigation is on the inter-relationship between two chemical mediators in the amplification of light in vision—calcium and cyclic GMP. Two questions were studied: whether calcium affects both the activation and deactivation of the light dependent hydrolysis of cyclic GMP by phosphodiesterase (PDE) in visual cells and the possible role of calmodulin in this activation and deactivation of PDE.

GRA

**N84-15784#** Columbia Univ, New York Dept. of Psychology  
**SPATIAL LOCALIZATION IN STRABISMIC OBSERVERS Phase Report, 10 Jun. 1982 - 10 Jun. 1983**  
 L. MATIN 10 Jun 1983 23 p  
 (Contract N62269-82-M-3208)  
 (AD-A132748, NADC-83049-60) Avail NTIS HCA02/MFA01  
 CSCL 06P

This report is an investigation of the way in which extraretinal eye position information (EEPI) is involved in the determination of localization and the possibility of flexibility and/or adaptation in the relation between the retinal image location (RI) and EEPI.

GRA

**N84-15785#** Rochester Univ, N Y Dept. of Medicine  
**EXPOSURE CHAMBER FOR STUDIES OF POLLUTANT GASES AND AEROSOLS IN HUMAN SUBJECTS: DESIGN CONSIDERATIONS**  
 M. J. UTELL, P. E. MORROW, R. W. HYDE, and R. M. SCHRECK  
 (General Motors Research Labs, Warren, Mich) 1983 10 p  
 refs Presented at the Ann Meeting of Assoc. for Aerosol Res, Munich, 13 Sep 1983  
 (Contract DE-AC02-76EV-03490)  
 (DE84-001135, DOE/EV-03490/2335, CONF-8309167-2) Avail  
 NTIS HC A02/MF A01

An exposure chamber was designed and built at the University of Rochester Medical Center for studies of human volunteers exposed to gaseous and/or aerosol pollutants for periods of hours to days. The 45 cu m chamber normally operates at an air change rate of 10 cu m/min with ranges in temperatures from 100 to 31.5°C and relative humidity from about 25 to 85%. Aerosols are produced by an eight-jet D-31 nebulizer, electrically neutralized and introduced into the chamber inlet air via a venturi mixer and five ceiling diffuser inlets. The aerosols can range in size from submicron to several microns and final chamber concentrations of 10 to several thousand micrograms per cubic meter can be produced having a spatial variation within the chamber of + or - 5% of the mean. The particulate environment within the chamber can be continuously monitored by a particle size analyzer and nephelometer and gas concentrations by chemical analyzers. Pollutant gases are obtained as standardized compressed gases

and introduced into the chamber via the same venturi mixer.

DOE

**N84-15786#** Research Inst of National Defence, Umea (Sweden)  
 Dept 4  
**DOSE CONVERSION FACTORS FOR INHALED RADIONUCLIDES**  
 L. SVENSSON Oct 1983 245 p refs  
 (Contract SSI/P103)  
 (FOA-C-40184-A3, ISSN-0347-2124) Avail NTIS HC A11/MF  
 A01

Dose conversion factors for internal dosimetry were computed and tabulated for inhaled radionuclides, using the International Commission on Radiological Protection task group inhalation model. Computed dose conversion factors relate absorbed dose in human tissue to inhaled activity with the time of integration as parameter. Tabulated dose conversion factors include contributions from naturally occurring and manmade radionuclides such as activation products, fission products and actinides.

Author (ESA)

**N84-15787#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)  
**MEDICAL ASPECTS OF SURVIVAL: TRAINING FOR AIRCREW**  
 T. VERHEIJ Jun 1983 23 p refs In FRENCH English  
 version document was announced as N83-22999  
 (AGARD-AG-283(FR), AGARD-AG-283(ENG),  
 ISBN-92-835-1442-4) Avail NTIS HC A02/MF A01

Maintenance of health, medical aid to survivors, general management of injuries, heat and cold exposure, specific injuries, survival illnesses, and medical aspects of escape and evasion are discussed.

Author

**N84-15788#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)  
**SLEEP AND WAKEFULNESS HANDBOOK FOR FLIGHT MEDICAL OFFICERS**  
 A. N. NICHOLSON (Inst of Aviation Medicine, Farnborough, England) and B. M. STONE (Inst of Aviation Medicine, Farnborough, England) Nov 1983 103 p In FRENCH Previously announced as N82-27972  
 (AGARD-AG-270(FR)) Avail NTIS HC A06/MF A01

Sleep and wakefulness related to aircrew and the aviation environment are discussed. Eight topics are covered: alertness and sleep, sleep, circadian rhythms, shiftwork, transmeridian flight, air operations and irregularity of work, disorders of sleep and arousal, and hypnotics.

N.W.

## 53

## BEHAVIORAL SCIENCES

Includes psychological factors, individual and group behavior, crew training and evaluation, and psychiatric research.

**A84-16653**  
**SELECTING PERFORMANCE AND WORKLOAD MEASURES FOR FULL-MISSION SIMULATION**  
 J. J. SKELLY and J. C. SIMONS (Systems Research Laboratories, Inc, Dayton, OH) IN: NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1082-1085.

A sustained full-mission simulation of a B-52 emergency war order mission has been designed with a view to producing a set of reliable operational baseline measurements representative of performance in a wartime mission. The workload measurements were obtained using the subjective workload assessment technique and three physiological techniques selected on the basis of their unobtrusiveness and previous validation in operational

environments Together with the performance data, these workload measures provided a sensitive index of effort associated with task performance Further, the correlated measures of performance and workload should provide data on the cumulative effects of workload as a contributing factor to the overall mission success V L

## A84-16654 SECONDARY TASK WORKLOAD ASSESSMENT METHODOLOGY

M S CRABTREE (Systems Research Laboratories, Inc, Dayton, OH) and C A SHINGLEDECKER (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1086-1089 refs

Preliminary results of a comparative survey of secondary tasks used in workload metrics are presented The secondary tasks are being assessed for possible inclusion in the Criterion Task Set described by Crabtree and Shingledecker (1982) The interval-production task (IPT), the Sternberg item-recognition test (SIRT), and the embedded secondary task (EST) are described, and experimental results are reviewed All three tests are found to be viable workload metrics, with the choice among them determined by the overall test goals and the work environment to be tested IPT provides minimum intrusion and sensitivity to operator strategies, SIRT, high diagnosticity, EST, low intrusion and good operator acceptance T K

## A84-16655 VISUALLY EVOKED RESPONSE FROM SUM OF SINES STIMULATION

K J PEIO (Systems Research Laboratories, Inc, Dayton, OH) and A M JUNKER (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1093-1098 refs

Steady state visually evoked cortical responses were obtained by sinusoidally modulated fluorescent lights Nine sine waves with a frequency range of 7.75 Hz to 21.75 Hz were presented simultaneously to subjects to allow a control theoretic examination of the transfer function of the EEG response Subjects observed the stimulus in a 'lights only' condition and were also tested viewing the flickering lights while doing a video decision task presented in the same field Results indicated that reconstruction of the transfer function across several frequencies was consistent for replications of each condition Differences between the decision condition and lights only were observed around 9.5 Hz to 11.5 Hz Frequency dependent sensitivity to the evoking stimulus was observed, and individual differences were indicated in frequency sensitivity to the evoking stimuli Author

## A84-16656 THE EFFECTS OF VARIATIONS IN TASK LOADING ON SUBJECTIVE WORKLOAD RATING SCALES

F T EGGEMEIER (Wright State University, Systems Research Laboratories, Inc, Dayton, OH), J Z MCGHEE (Systems Research Laboratories, Dayton, OH), and G B REID (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1099-1105 refs

Twelve subjects (Ss) performed a memory update task at several levels of stimulus presentation rate and memory load Subsequent to task performance, Ss rated the workload associated with each condition using the Subjective Workload Assessment Technique (SWAT) The results indicated that the three component scales (time, effort, stress) of the SWAT procedure demonstrated complementary sensitivity patterns to variations in memory task demands These sensitivity patterns are interpreted as supporting

the inclusion of the three component scales in SWAT Implications for use of subscale analyses as a diagnostic procedure are also discussed Author

## A84-16657 UTILITY AND UTILIZATION OF ADVANCED INSTRUCTIONAL FEATURES IN AIRCREW TRAINING DEVICES. I - TACTICAL AIR COMMAND

D J POLZELLA (Dayton, University, Williams AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1108-1115

The Aircrew Training Device (ATD) is not merely a flight simulator It is also equipped with sophisticated hardware and software capabilities, known as advanced instructional features (AIFs), which permit a flight crew instructor to control, monitor, and record flight simulation training sessions A survey conducted at five of the principal Tactical Air Command ATD sites revealed that instructors receive minimal training in the use of AIFs and that most features are rarely used In fact, many instructors were unaware that certain features were even available Although several AIFs were judged to have significant value in replacement and/or continuation training, it is clear that instructors will need to be educated in their effective use Author

## A84-16658 THE INSTRUCTOR, COMPUTER MANAGED INSTRUCTION, AND THE FLIGHT SIMULATOR

C MEYN (Logicon, Inc, Tactical and Training Systems Div, San Diego, CA) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1120-1123

The incorporation of computer-managed instruction (CMI) into the flight simulator is discussed CMI consists of those areas, commonly considered instructor or instructor aide functions, which are capable of being assumed by a computer Standardized functions, such as mechanical control of the trainer, training syllabus control, and performance measurement, are all capable of being assumed by CMI An instructor support system (ISS) is described which, when connected to an aircraft simulator, provides many CMI functions Student records are retained in the system for review and debriefing functions, missions scenarios are generated, and audit trails are maintained for statistical analysis Procedures monitoring assesses sequences in such areas as flight checklists and emergency procedures The future uses of CMI and the ISS are also examined V L

## A84-16661 THE IMPACT OF DISPLAY SIZE ON CONTINUOUS AND DISCRETE ANTICIPATORY CUES

S D DETRO and R P BATEMAN (Systems Research Laboratories, Inc, Dayton, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1147-1150 refs

An austere symbology set for a weapons release task was evaluated in a 2 x 2, within subjects, factorial design to evaluate the effects of the length of the line and the mode (continuous versus discrete) of movement on weapons release accuracy. Twenty-four tactical pilots performed ten repetitions of the four treatment conditions The task was for the pilot to push a weapon release button when he perceived a vertically growing line exactly reaching a stationary horizontal line The dependent variable was the error in milliseconds Analysis of variance showed that there was a significant interaction between the length of line and the mode of line movement, with the error for the longer discrete mode much greater than other combinations The use of the shorter length tracking line significantly increased performance accuracy. The continuously growing tracking line produced significantly greater accuracy than the symbology that grew in discrete steps

Author

A84-18144#

**EFFECTIVENESS OF TWO-DIMENSIONAL SIMULATION IN AVIONICS PROCEDURAL TRAINING**

D C HAGEMAN (American Airlines Training Corp., Fort Worth, TX) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan 9-12, 1984 10 p refs (AIAA PAPER 84-0516)

Inertial navigation systems are an important component of modern aircraft, and the capability to operate the inertial navigation system is a critical aircrew training system requirement. The present investigation has the objective to empirically determine the capability of two-dimensional computer-assisted simulation to predict specific on-task competencies, and to contribute to documented research on the effectiveness of two-dimensional simulation in avionics procedural training. One hundred pilot and flight engineer U.S. Air Force aircrew members participated in a study. The results of the study provide an empirical validation of the capability of computer-generated graphic simulations of inertial navigation system equipment to predict on-task competencies for the performance of specific procedural tasks required to operate inertial navigation system equipment. G.R.

A84-18760

**CENTRAL CONTROL OF MOVEMENT TIMING**

D A ROSENBAUM (Hampshire College, Amherst, MA) Bell System Technical Journal (ISSN 0005-8580), vol 62, Aug 1983, p 1647-1657 refs

The mechanisms of movement timing are investigated. Although the type of movement is restricted to simple finger sequences, the experiment suggests that even when peripheral feedback is available, central programs play a controlling role in movement timing. The basis for this conclusion is that the mean reaction time for the first of two responses is longer than the mean reaction time for a single, isolated response, even when the time between the first and second response exceeds one second. That the lengthening of reaction times at such long delays is in fact attributable to some aspect of the control of movement time is indicated by the fact that the lengthening of reaction times is greater when the interresponse interval is controlled more precisely. The data also allow for a relatively detailed model of the control of movement timing. This model likens the selection and control of an interresponse interval to the setting and running of a conventional alarm clock. Here, the desired number,  $n$ , of clock pulses is selected (during the reaction time), the clock is then allowed to produce the  $n$  pulses in such a way that the first response is triggered at the time of the first pulse and the second response is triggered at the time of the  $n$ th pulse. C.R.

A84-18777

**QUARTERBACKS AS CORNERBACKS OR AMERICAN FIGHTER PILOTS IN MIGS - A STUDY OF REVERSE ROLE TRAINING**

K R LAUGHERY, JR (Calspan Advanced Technology Center, Boulder, CO) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 6-9

This study tested a training concept termed reversed-role training. Reverse-role training involves practice by an individual on tasks which he does not perform in the operational environment but his operational performance is dependent upon others performing these tasks. This can be best perceived in terms of game playing, such as air-to-air combat, whereby the player will receive practice playing the opponent's position (e.g., American fighter pilots receiving training in Soviet aircraft). A study was conducted in which 32 subjects were trained to play a video air-to-air combat game with each 'aircraft' having different performance characteristics. Results indicated significant differences on a number of strategy measures and a probable interaction with aircraft type on the number of wins, losses, and draws. Author

A84-18778

**TRAINING SPATIAL SKILLS FOR AIR-TRAFFIC CONTROL**

W. SCHNEIDER, M. VIDULICH, and Y-Y YEH (Illinois, University, Champaign, IL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 10-14 refs

Guidelines for microprocessor based skill trainers are presented. A training program for air traffic control (ATC) of rendezvous for inflight refueling is described. The program seeks to optimize practice for developing automatic component skills. The program sequences the trainee through 10 stages to develop spatial skills for ATC. The resulting training program can develop fast, accurate, and reliable performance on the individual components with only a few hours' training per component. The proposed approach is contrasted with current training methods. The general applicability of the guidelines to microprocessor based skill trainers is described. Author

A84-18779

**YOKED DESIGN AND SECONDARY TASK IN ADAPTIVE TRAINING**

D F JOHNSON, R C HAYGOOD, and W M OLSON (Arizona State University, Tempe, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 21-24 refs

This paper describes two methodological innovations in the study of adaptive training. The first is the use of a yoked design to insure that the average level of task difficulty for fixed-difficulty subjects is the same as the average level of difficulty reached by adaptive subjects. The second is the demonstration of the feasibility of using a secondary (subsidiary, non-loading) task to furnish the adaptive criterion for changing the difficulty level of the primary task. The results of two experiments are reported. Both experiments demonstrate the feasibility and utility of yoked design and adaptation on secondary task performance in adaptive training. Author

A84-18780#

**FLYING ABILITY AND UNDERSTANDING OF VEHICLE CONTROL DYNAMICS**

J DE MAIO (USAF, Human Resources Laboratory, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 25-29 refs

Research investigated the ability of pilots of differing experience and capability to make vehicle control decisions. Three groups of pilots and three groups of pilot trainees performed the Flight Decision-making Assessment Task (FDAT). The FDAT is a micro-computer based, discrete-time vehicle control task. Differences in FDAT performance were found as a function of pilot capability. Results are discussed in terms of pilot capability and of decision factors involved in vehicle control. Author

A84-18782

**THE EFFECTS OF WARNING MESSAGE HIGHLIGHTING ON NOVEL ASSEMBLY TASK PERFORMANCE**

M A ZLOTNIK (California State University, Northridge, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 93-97 refs

A review of examples and specifications relating to critical operating procedures revealed considerable variation in recommended standards for highlighting warning messages. An experiment was therefore conducted to examine the effectiveness of various methods of highlighting warning messages contained in the instructions for a novel assembly task. Findings indicated that the presence of warning messages shortened task completion times and reduced error rates between the experimental and control groups. Author

A84-18783

**MITIGATION OF PERFORMANCE DECREMENT IN TRANSIENT EXTREME HEAT**

P A HANCOCK (Illinois University, Champaign, IL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 137-141 refs

This paper examines the effect of operator skill level upon performance in transient extreme heat. Previous work has indicated that task familiarity is beneficial in prolonging efficient performance in elevated environmental temperature. It is proposed that such familiarity is subsumed by automated responses, with respect to consistent components of individual task demands. These components, developed through consistent mapping of stimulus and response relationships, remain essentially unimpaired by the thermal stressor. In contrast, heat may induce potentially dangerous decrement in both inconsistent elements of practiced tasks and performance in novel or emergency situations. The automatic and control processing framework may be applied to performance variation under alternate environmental stressors and is of potential importance to those who have occasion to require personnel to operate in non-optical environmental conditions. Author

A84-18785

**AGE AND INFORMATION PROCESSING**

J MORAAL (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Instituut voor Zintuigfysiologie TNO, Soesterberg, Netherlands) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 184-188 refs

In view of accumulated empirical evidence indicating that one of the effects of aging is a slowing down of behavior, it is presently asked whether this slowing affects all subprocesses or stages of information processing, or whether it can be localized in one or more specific stages. An assessment of studies on the stage analysis of the reaction process leads to the conclusion that there is no converging empirical evidence favoring one of the two alternative hypotheses. Research findings are, however, noted to support the assumption of a lowering of the signal/noise ratio with increasing age (a lowering of the strength of the signals coming from the sense organs to the brain, and from one processing stage to another). O C

**A84-18791\*# BATTLE COLUMBUS LABS, MOUNTAIN VIEW, CALIF  
FLIGHT CREW PERFORMANCE WHEN PILOT-FLYING AND PILOT-NOT-FLYING DUTIES ARE EXCHANGED**

H W ORLADY (Battelle Columbus Laboratories, Mountain View, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 307-311 (Contract NAS2-10060)

This study compares reports from the ASRS database depicting operational anomalies related to flight crew performance when pilot-flying and pilot-not-flying duties were exchanged. A greater number of near midair collisions, takeoff anomalies, and crossing altitude deviations were reported when the Captain was flying. More altitude deviations, near midair collisions during approach, and landing incidents occurred when the First Officer was flying. There were differences in monitoring effectiveness and in the type and distribution of information transfer problems associated with the anomalies. In addition, a number of crew performance factors were noted that were not affected by the exchange of duties. Several of these were deemed important enough to be included as matter of general interest. Author

A84-18793

**VISUAL/PERCEPTUAL ASPECTS OF AN F-4G ACCIDENT**

R S KELLOGG (Dayton, University, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 316-318

On July 6, 1981, an F-4G aircraft participating in a Red Flag tactical warfare exercise crashed in low lying mountains during terrain masking defensive maneuvers. Careful examination of the terrain in which the crash occurred has revealed a high potential for visual/perceptual misinterpretation. Sightings taken several yards short of the impact point have shown that mountains in the background appear much higher than the impact point, although this point is actually 20 ft higher. This disorientation of the F-4G crew with respect to spatial elevation is suggested to have been the cause of the crash. O C

A84-18794\*# San Jose State Univ, Calif

**THE RELIABILITY AND VALIDITY OF FLIGHT TASK WORKLOAD RATINGS**

M E CHILDRESS (San Jose State University, San Jose, CA), S G HART (NASA, Ames Research Center, Moffett Field, CA), and M R BORTOLUSSI (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 319-323 (Contract NCC2-34, NAG2-17)

Twelve instrument-rated general aviation pilots each flew two scenarios in a motion-base simulator. During each flight, the pilots verbally estimated their workload every three minutes. Following each flight, they again estimated workload for each flight segment and also rated their overall workload, perceived performance, and 13 specific factors on a bipolar scale. The results indicate that time (a priori, inflight, or postflight) of eliciting ratings, period to be covered by the ratings (a specific moment in time or a longer period), type of rating scale, and rating method (verbal, written, or other) may be important variables. Overall workload ratings appear to be predicted by different specific scales depending upon the situation, with activity level the best predictor. Perceived performance seems to bear little relationship to observer-rated performance when pilots rate their overall performance and an observer rates specific behaviors. Perceived workload and performance also seem unrelated. Author

A84-18797#

**REPRESENTING HUMAN COGNITION IN COMPLEX MAN-MACHINE ENVIRONMENTS**

C R HALE (BDM Corp, McLean, VA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 334-338 refs (Contract F33615-81-C-3620)

The preliminary components of a model intended to identify and characterize the elements responsible for cognitive behavior in complex man-machine environments are presented. The framework within which this is attempted is the N-squared diagram (Lano, 1977). Nine F-16 pilots served as subjects. An F-16 training mockup is employed to work through the scenario developed for the study. Four levels of representation regarding a pilot's interaction with his aircraft during a combat mission are identified. The functions making up the topmost level can be conceptualized as a set of schemata through which the pilot manages the mission and controls his aircraft. These schemata serve primarily as a set of control programs within which the next level of representation is contained. This next (second) level can be instantiated in order for the goals of the schemata to be realized. At the third level of representation, each subroutine is expressed as a set of cognitive processes designed mainly to accomplish analytical goals. At the lowest (fourth) level of representation are the elementary information processes. It is noted that these are relatively invariant processes, the primary purpose of which is the manipulation of data. C R

**A84-18806#****EFFECTS OF TASK STRUCTURES ON ATTENTION ALLOCATION OPTIMALITY**

P S TSANG (Illinois, University, Urbana, IL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 465-469 refs  
(Contract N00014-79-C-0658)

The experiment reported examined the hypothesis that more optimal allocations would occur between time-shared tasks that place heavy demands on common processing resources (similar task structures) than tasks that utilize separate resources (dissimilar task structures). Two dual task configurations differing in their degree of demand for common resources were employed. The structurally similar pairs consisted of two compensatory tracking tasks whereas the dissimilar pair consisted of a tracking and a short term memory task. Demand for common resources was further manipulated by employing four combinations of different I/O modalities for the memory task. Relative use of the task-specific resources were manipulated through priority instructions and dynamic difficulty changes. Results generally support the hypothesis and suggest that certain dimensions that defined the resources (stages of processing, I/O modalities, and processing codes) assert greater influence on allocation optimality than others. Implications for decisions on multitask designs were speculated.

Author

**A84-18808****MENTAL STRESS QUANTIFICATION AND IDENTIFICATION DECISION MODELING**

A MITAL (Cincinnati, University, Cincinnati, OH) and O M. ULGEN (Michigan, University, Dearborn, MI) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 474-478 refs

This paper describes an approach to quantify mental stresses. The tool of fuzzy set theory is used to model the information regarding the job (task) and operator's mental and clinical status. Utilizing this concept, a model is developed to aid in decision making under those circumstances when an operator (responsible for performing critical tasks, such as monitoring ground support equipment) is under the influence of mental stress and his/her ability to continue on the job, without making fatal mistakes, is temporarily compromised. The objective of the decision model is to make the operator-task assignments based on the fuzzy operator and task information matrices. The decision alternatives are (1) assign the operator to a non-critical job, (2) give the operator time off for recovery, and (3) let the operator continue on the job. The model takes into account the physiological, the psychological/behavioral, and the performance parameters and dynamically reviews the operator status using the data base unique to the individual.

Author

**A84-18809#****CHANGES IN MAZE-SOLVING ERRORS DUE TO STRESS**

S L WARD and R J POTURALSKI (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 479-482

An examination is made of the use of maze-solving problems as tools for the assessment of the effects of stress, which is induced by limiting the amount of time available for subject input. In the first of the experiments reported, the problem involved the isolation of a particular maze configuration which would show reliable and sensitive differences among a range of dot speeds. The second experiment assessed the effect of repeated presentation on performance, and the last investigated the effect of dot speed on maze performance using a 'within subject' design together with the maze configuration chosen in the first experiment. In all three cases, dot speed increases yielded reliable performance decrements. The errors that occurred were typically errors of commission, rather than simple failures of motor coordination.

These tendencies indicate that performance score decrements with increasing dot speed are due to a shortened planning horizon.

OC

**A84-18817****GENDER DIFFERENCES IN RESPONSE TO AMBIENT COLOR, TASK COMPLEXITY AND PRESENCE OF EVALUATIVE OTHERS**

D J POND (Harris Corp., Melbourne, FL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 590-594 refs

Sixty-four male and thirty-two female subjects each performed a CRT pursuit tracking task in one of the eight conditions created by combinations of task difficulty (simple versus complex), evaluative audience presence versus absence, and wall color (red versus green). Females recorded significantly higher error scores, were less aroused and more sensitive to ambient color than were their male counterparts. Further, audience presence was found to enhance male and impair female tracking performance. Results suggest that differentials in subject motivation may have affected the present research.

Author

**A84-18819#****GENDER DIFFERENCES AND COGNITIVE ABILITIES IN THE TRANSFER OF TRAINING OF BASIC FLYING SKILLS**

T M MCCLOY and J F SWINEY (U.S. Air Force Academy, Colorado Springs, CO) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 602-604 refs

Eighteen Air Force Academy cadets, ten male and eight females, participated in an experiment designed to investigate gender differences in the retention of basic flying skills, and the transfer of training between several basic instrument maneuvers. Additionally, the utility of several cognitive factors in predicting flying performance was investigated. The results indicated that males and females maintain basic instrument flying skills approximately equally well over an intervening period as long as one year. Additionally, gender differences in transfer of training may result from different abilities required by the specific maneuvers as opposed to failure to transfer previously learned skills. Finally, certain cognitive measures exhibit definite utility in predicting flying performance.

Author

**A84-18823#****AN INDIVIDUAL DIFFERENCES APPROACH TO SWAT SCALE DEVELOPMENT**

G B. REID (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH), F T EGGEMEIER (Systems Research Laboratories, Inc., Wright State University, Dayton, OH), and T E NYGREN (Ohio State University, Columbus, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 639-642 refs

A refinement to the scale development phase of the Subjective Workload Assessment Technique (SWAT) provides for forming scales for homogeneous subject groups. Groups are formed by determining which of the three dimensions, time load, mental effort load or stress load subjects judge to be the most important contributor to workload. The group scales are then transformed into a SWAT scale that ranges from 0 for the lowest defined workload condition to 100 for the highest workload condition. This procedure should increase the precision of workload measurement while minimizing the effects of individual subject ranking errors.

Author

**A84-18824#**

## **SUBJECTIVE WORKLOAD ASSESSMENT IN A MEMORY UPDATE TASK**

F T EGGEMEIER (Wright State University, Systems Research Laboratories, Inc., Dayton, OH), M S CRABTREE, J J ZINGG (Systems Research Laboratories, Inc., Dayton, OH), G B REID, and C A SHINGLEDECKER (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 643-647 refs

Twelve subjects performed a short-term memory task under several difficulty levels and rated the workload associated with each condition using the Subjective Workload Assessment Technique (SWAT). SWAT ratings proved more sensitive than memory error to task difficulty variations in all but one of the most difficult memory conditions. Most importantly, SWAT ratings demonstrated their greatest relative sensitivity at the lowest levels of workload. The results are interpreted as supporting the applicability of SWAT as a sensitive workload index. Author

**A84-18832\*#** North Carolina Univ. at Greensboro

## **SHORT-TERM MEMORY AND DUAL TASK PERFORMANCE**

J E REGAN (North Carolina University, Greensboro, NC) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 803-807 refs (Contract NSG-2390)

Two hypotheses concerning the way in which short-term memory interacts with another task in a dual task situation are considered. It is noted that when two tasks are combined, the activity of controlling and organizing performance on both tasks simultaneously may compete with either task for a resource, this resource may be space in a central mechanism or general processing capacity or it may be some task-specific resource. If a special relationship exists between short-term memory and control, especially if there is an identity relationship between short-term and a central controlling mechanism, then short-term memory performance should show a decrement in a dual task situation. Even if short-term memory does not have any particular identity with a controlling mechanism, but both tasks draw on some common resource or resources, then a tradeoff between the two tasks in allocating resources is possible and could be reflected in performance. The persistent concurrence cost in memory performance in these experiments suggests that short-term memory may have a unique status in the information processing system. C R

**A84-18833**

## **INDIVIDUAL DIFFERENCES AND STIMULUS DISCRIMINABILITY IN VISUAL COMPARISON REACTION TIME**

D A DUPREE and C D WICKENS (Illinois University, Urbana, IL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 809-811 refs

Individual subjects' reaction time functions in a simple visual comparison task were found to be substantially correlated with measures of spatial ability. In an additional task requiring responses to target stimuli flanked by stimuli associated with competing responses, a sample of high spatial subjects showed little deficit in performance, while a sample of low spatial subjects showed large deficits in performance compared to reaction time to a target stimulus presented alone. These results were interpreted in terms of the interaction between human aptitude and task requirements. The experiments reported are part of an ongoing investigation of spatial ability and visual information processing. Author

**A84-18835#**

## **THE EFFECTS OF NOISE ON PERFORMANCE OF A VISUAL DISCRIMINATION TASK**

V J GAWRON (Calspan Advanced Technology Center, Buffalo, NY) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 816, 817 refs (Contract NSF DAR-78-12722)

The effects of noise on visual discrimination performance was investigated. Eight subjects performed a line-judgment task at three levels of noise (55, 70, 85 dBA) and two levels of task complexity (single and dual task). Although there was no reliable effect of noise on visual discrimination performance (i.e., speed and accuracy), there was, however, a reliable task complexity effect. Single-task (task performed alone) average response time was reliably shorter than dual-task (task paired with itself) average response time. Author

**A84-18837#**

## **DEVELOPMENT OF SENSITIVE PERFORMANCE MEASURES FOR SELECTION OF CREWS FOR FLIGHT TRAINING**

E M CONNELLY (Performance Measurement Associates, Inc., Vienna, VA) and B D SHIPLEY, JR (U.S. Army, Research Institute, Fort Rucker, AL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 825-829 Army-supported research refs

It is pointed out that in the past measurement of mission performance was limited to summary measures which provided a single score for the total mission. Such summary measures are not sensitive to factors which influence moment-to-moment performance. For instance, if a wind gust causes a large altitude error, the summary measure would not take into account the way in which the pilot corrects the error. It is argued that measurement of the error recovery ability of a candidate pilot should permit an improved prediction of subsequent aviation performance. A description is provided of a method of developing sensitive, system performance measures. This method represents the part of an effort to test the error recovery hypothesis. An analysis model is discussed, giving attention to the transition analysis method, analyses on performance data, analytic procedures, and results. G R

**A84-18840#**

## **VISUAL CHANNEL SENSITIVITY AND PILOT PERFORMANCE IN A FLIGHT SIMULATOR**

R KRUK, D M REGAN, K I BEVERLEY (Dalhousie University, Halifax, Canada), and T M LONGRIDGE (USAF, Human Resources Laboratory, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 885-889 Sponsorship Natural Sciences and Engineering Research Council refs (Contract NSERC-A-0323, AF-AFOSR-78-3711)

In previous research significant correlations were found between measures of sensitivity in certain hypothetical visual channels and simulated landing performance under degraded visibility. The present study replicated the earlier findings, and extended the approach to a broader cross section of flight tasks. An additional psychophysical test of superthreshold velocity discrimination was found to exhibit significant correlation with formation flight precision and with manual weapons delivery performance. Author

**A84-18844**

## **TYPE OF TASK PRACTICE AND TIME-SHARING ACTIVITIES PREDICT PERFORMANCE DEFICITS DUE TO ALCOHOL INGESTION**

A D FISK and W SCHNEIDER (Illinois University, Urbana, IL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 926-930 refs

The confusion regarding the situations in which performance will decline with alcohol intoxication is thought to derive from an



inappropriate classification of the information processes involved in task performance. The research reported here uses principles of automatic/controlled processing theory to assess the effects of alcohol. The performance through automatic processing is only slightly degraded by alcohol, the deleterious effect of alcohol is more pronounced, however, in controlled processing tasks. The results suggest that the type of practice and, therefore, the type of information processing predicts the decline in performance caused by alcohol. Alcohol brings about a general reduction in resources and in the ability to share resources both within and between tasks. C R

#### A84-19277#

##### **GENDER AND COGNITIVE ABILITIES IN THE ACQUISITION AND TRANSFER OF BASIC FLYING SKILLS - ANOTHER LOOK**

T M MCCLOY, F R WOOD, and M N STOLLINGS (U.S. Air Force Academy, Colorado Springs, CO) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 6-8 refs

In previous investigations of gender differences in the acquisition and transfer of basic flying skills, it had been found that there are certain performance differences. Trying to account for these results, the hypothesis had been advanced that the observed differences are more likely a consequence of previous differential male and female exposure to similar types of tasks, than some innate differences in motor abilities or learning rates. The present investigation has the objective to obtain some information regarding the correctness of this hypothesis. Fifteen male and 15 female cadets participated in the study. On the basis of tests providing scores for the spatial relations and visualization factors, subjects were categorized into high, medium, and low scorers. Five males and five females with matching scores were selected to represent each of the three groups. The results lend strong support to the considered hypothesis. G.R

#### A84-19284#

##### **INDIVIDUAL DIFFERENCES AND AGE-RELATED CHANGES IN TIME-SHARING ABILITY OF AVIATORS**

R BRAUNE and C D. WICKENS (Illinois, University, Urbana, IL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 117-121 refs (Contract N00204-82-C-0113)

Performance in single task and dual task configurations was examined across four different age groups to determine the presence of an attention deficit hypothesis with increasing chronological age. Although a general slowing of performance could be shown no interaction between age and dual task loadings could be observed which is interpreted as negative evidence for the attention deficit hypothesis. A separate analysis revealed individual differences in time-sharing ability within age groups to be a significant factor in dual task performance. Author

A84-19286\*# Virginia Polytechnic Inst and State Univ., Blacksburg

##### **A VALIDATED RATING SCALE FOR GLOBAL MENTAL WORKLOAD MEASUREMENT APPLICATIONS**

W W WIERWILE and J G CASALI (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 129-133 refs (Contract NAG2-17)

The Cooper-Harper (1969) scale has been extensively used for evaluation of aircraft handling qualities and associated mental workload. The scale is a 10-point scale with a decision tree. A modified version of the scale, called the MCH scale, has been devised for the purpose of assessing workload in systems other than those where the human operator performs motor tasks; namely, where perceptual, mediational, and communications activity is present. The MCH scale has been validated in three different

experiments. The scale is recommended for applications in which overall mental workload is to be assessed. Author

#### A84-19287#

##### **EXAMINATION OF WORKLOAD MEASURES WITH SUBJECTIVE TASK CLUSTERS**

W L DERRICK (U.S. Air Force Academy, Colorado Springs, CO) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 134-138 refs

Multiple measures of operator workload may fail to agree or dissociate for a given task. This study proposes a new method to examine this dissociation for two categories of workload measures: Subjective ratings and performance-based secondary tasks. Eighteen tasks of differential processing resource demand were performed by subjects and rated according to workload similarity. Additive clustering analysis of the workload ratings produced overlapping task clusters. Three properties - performance, effort, and input complexity explained the cluster solution. Dissociation was found when tasks perceived as similar in workload did not possess the same properties. Author

#### A84-19288

##### **THE EFFECT OF DELAYED REPORT ON SUBJECTIVE RATINGS OF MENTAL WORKLOAD**

F T EGGEMEIER (Wright State University, Systems Research Laboratories, Inc., Dayton, OH), M S CRABTREE (Systems Research Laboratories, Inc., Dayton, OH), and P A LAPOINTE (Wright State University, Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 139-143 refs

Forty-eight subjects performed a short-term memory task with several difficulty levels and provided either immediate or delayed ratings of workload via the Subjective Workload Assessment Technique (SWAT). Mean SWAT ratings did not vary significantly as a function of delayed report, but a substantial number of subjects gave delayed ratings that were discrepant from their immediate ratings. A counterbalancing effect in delayed ratings appears to have been a factor in the failure of the delay effect to reach significance. A secondary objective of this study was to examine the sensitivity of SWAT in a between-subjects design. SWAT ratings varied significantly as a function of task difficulty manipulations, supporting the sensitivity of SWAT to the workload of the conditions used. Author

#### A84-19290#

##### **THE ASSESSMENT OF WORKLOAD - DUAL TASK METHODOLOGY**

A D FISK (AT & T, New York, NY), W L DERRICK (U.S. Air Force Academy, Colorado Springs, CO), and W SCHNEIDER (Illinois, University, Urbana, IL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 229-233 refs

During the last few years the utilization of mental workload considerations for human engineering decisions has increased substantially. Methods for assessing operator workload are related to subjective opinions, physiological measures, and secondary or dual task methods. Dual task methods attempt to index the spare mental capacity of the occupied operator, or, conversely, provide a suggestion regarding the amount of cognitive effort/resource demand of the primary task. In connection with the present investigation, it is argued that any dual task workload assessment which implicitly or explicitly accepts certain assumptions will produce ambiguous results. Instead, attention is given to three criteria which, it is felt, must be met to conduct valid workload assessment employing secondary task methodology. G R



A84-19293\*# Illinois Univ, Urbana

**THE DISSOCIATION BETWEEN SUBJECTIVE WORKLOAD AND PERFORMANCE A MULTIPLE RESOURCE APPROACH**

C D WICKENS and Y-Y YE (Illinois, University, Urbana, IL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 244-248 NASA-supported research refs

A theory of the dissociation between subjective measures of mental workload and performance is described. The theory proposes that subjective measures are heavily driven by the number of tasks or task elements that a subject must perform concurrently. However they are relatively less sensitive to whether these tasks compete for common or separate resources, and to the difficulty of a single task, particularly if this difficulty is related to response factors. Performance, on the other hand, is particularly influenced by single task difficulty of both a perceptual and response nature and by resource competition between tasks. A set of three experiments are described to examine the dissociation between subjective difficulty measures and performance. These experiments employ different combinations of three tasks: tracking, memory search, and a simulated air traffic control problem. The results supported all forms of dissociation predicted by the theory and the implications of results to workload measurement are discussed.

Author

A84-19307\*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

**HUMAN FACTORS IN SPACELAB - CREW TRAINING**

M K JUNG (NASA, Ames Research Center, Life Sciences Flight Experiments Project Office, Moffett Field, CA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 552-556

At NASA-Ames Research Center's Life Sciences Flight Experiments Project Office two payloads for the Shuttle Spacelab are currently in development. The first payload, Spacelab-3, will launch in November 1984. Unique life sciences hardware designed to support animals in 0-g will fly for the first time. Flight crew training sessions for the Spacelab-3 astronauts began in June 1982. Human factors involvement is extensive. A thorough understanding of both the 1-g and 0-g environments is necessary. The weightlessness of the space environment creates special conditions, e.g., the time required for a 1-g laboratory experiment significantly increases in 0-g. The transportation of objects in 0-g uses different techniques than on earth. These considerations, plus others, are incorporated into the design of the Spacelab-3 crew training program.

Author

A84-19320#

**PERSONALITY AND MOTIVATIONAL FACTORS OF U.S. NAVAL ACADEMY GRADUATES AS INDICATORS OF AVIATION MISHAP POTENTIAL**

R. A. ALKOV, M S BOROWSKY, J A GAYNOR (U S Naval Safety Center, Norfolk, VA), and K MONTOR (U S Naval Academy, Annapolis, MD) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 838-842 refs

The results of personality tests given to candidate naval aviators were compared with accident rates of those aviators and the results are presented. Those aviators with lower pilot factor aircraft mishap rates are less self-confident, low in leadership, either high or low in pugnacity/sadism, intermediate in self-sufficiency vs. group dependency, and lower in sex drive than those who have higher pilot factor rates. Those who are more outgoing than reserved, more family-oriented, low in self-sentiment but neither too fearful nor fearless have lower overall mishap rates, regardless of mishap causal factors.

C D

A84-19324

**PERFORMANCE MEASURES FOR AIRCRAFT CARRIER LANDINGS AS A FUNCTION OF AIRCRAFT DYNAMICS**

E M CONNELLY (Performance Measurement Associates, Inc., Vienna, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 911-915 refs

A theory of performance measurement for operator-controlled systems is presented. The theory permits a system performance measure to be synthesized which scores performance on successive data samples based on the impact of the sampled performance on the overall summary of performance. The dynamics of the controlled element (the aircraft) is effectively removed from the measurement even through the pilot continues to control the aircraft. The development of measures for aircraft carrier landings as to the glide path and angle of attack control channels is shown. The results suggest that the command display offers improved glide path control, especially during daylight conditions. The technique permits the relationship between performance and factors that change during the flight to be determined. It bypasses time delays due to aircraft dynamics, permitting evaluation of performance on short flight intervals.

C D

A84-19326#

**VISUAL CUEING EFFECTIVENESS - COMPARISON OF PERCEPTION AND FLYING PERFORMANCE**

J DE MAIO, R BROOKS, J BRUNDERMAN (USAF, Human Resources Laboratory, Williams AFB, AZ), and E J RINALDUCCI (Georgia Institute of Technology, Atlanta, GA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 928-932 refs

De Maio and Brooks (1982) used a free modulus altitude estimation task to evaluate the altitude cueing effectiveness of flight simulator visual environments. The present investigation extends the findings of De Maio and Brooks to more detailed visual environments, taking into account a study of the relationship between altitude perception and flying performance. Two experiments with Air Force pilots and instructor pilots as subjects were conducted. It was found that altitude perceptibility is a valid metric of the ability of a simulator visual display environment to provide a pilot information needed to maintain altitude in low level flight. A potent cue for altitude perception is provided by the distribution, or flow, of environmental features.

G R

A84-19329#

**VISUAL PERCEPTUAL AND HUMAN PERFORMANCE FACTORS INVOLVED IN LOW LEVEL, HIGH SPEED FLIGHT**

R S KELLOGG (Dayton, University, Williams AFB, AZ), T LONGRIDGE (USAF, Human Resources Laboratory, Williams AFB, AZ), and M MILLER (USAF, Fighter Weapons School, Tucson, AZ) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 941, 942.

N84-14682# Materials Research Labs, Melbourne (Australia)

**A PRELIMINARY ASSESSMENT OF OBSERVER EXPECTATIONS IN TARGET DETECTION TASKS**

C J WOODRUFF and G S M WEBB Jul 1983 40 p refs (MRL-R-893, AR-003-306) Avail NTIS HC A03/MF A01

The determination of soldiers' expectations as to what target features would cause detection of stationary M13 vehicles was examined. Results show that a scenario procedure is appropriate. A factor analysis of the expectations scales isolated four factors underlying the communality of these scales, however, there is considerable unique variance associated with each scale. The interpretation of these factors is discussed, and modifications to the scenario scales for future use are outlined. Results of an attempt to collect data on actual causes of detection during a live exercise show that such data cannot be effectively gathered under these conditions.

Author

**N84-14683#** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va  
**TRAINING FEEDBACK HANDBOOK Final Report, Sep. 1982 - Jan. 1983**

B L. BURNSIDE, B G WITMER, and D M KRISTIANSEN Jan 1983 87 p  
 (Contract DA PROJ 2Q2-63743-A-794)  
 (AD-A132565, ARI-RP-83-7) Avail NTIS HCA05/MFA01  
 CSCL 05I

This handbook is designed to assist training developers and evaluators in structuring their collection of feedback. Six methods of collecting feedback are described, and practical guidelines for their application are offered. Issues in the management and analysis of feedback are also discussed. Author (GRA)

**N84-15099#** Vliegbasis Volkel (Netherlands)  
**PHYSIOLOGICAL AND PSYCHOLOGICAL ASPECTS OF THE PILOTING OF MODERN HIGH-PERFORMANCE COMBAT AIRCRAFT**

J C F AGHINA In AGARD Flight Mech and System Design Lessons from Operational Experience 3 p Oct 1983  
 Avail NTIS HC A15/MF A01

Since 1978 the Royal Netherlands Air Force has gained a lot of experience in handling a totally new aircraft, the F-16, which differs in many aspects from its predecessors. Not only the pilots, but the technicians too, had to adapt themselves to the new aircraft and they learned how to handle entirely new systems. The F-16 is a modern high performance fighter, like the F-4 and the F-15, and has caused problems for the pilots in comparison with former types, the F-104 and the NF-5. The extreme mobility of the aircraft produces not only a high gravity factor as such, but also a rapid G onset rate, by which a number of gravity depending physiological problems have arisen in a very obvious way. Furthermore, as a result of many technological innovations applied, i.e., aircraft's electronics, the pilot's task has also changed considerably, in particular with respect to the amount of information to be processed. The question arises of whether new approaches should be introduced into the selection, the physiological standards, the training, the supervision and the coaching of the operational pilots. Author

**N84-15789\*#** National Aeronautics and Space Administration, Washington, D C

**A STUDY ON AIRBORNE INTEGRATED DISPLAY SYSTEM AND HUMAN INFORMATION PROCESSING**

K MIZUMOTO, H IWAMOTO, S SHIMIZU, and I KURODA Sep 1983 19 p refs Transl into ENGLISH from Japan Air Self Defence Force, Aeromedical Lab Reports (Japan), v 23, no 3, Sep 1982 p 77-88. Original language document was announced as A83-26086. Transl by Kanner (Leo) Associates, Redwood City, Calif  
 (Contract NASW-3541)  
 (NASA-TM-77338, NAS 1 15 77338) Avail NTIS HC A02/MF A01 CSCL 05I

The cognitive behavior of pilots was examined in an experiment involving mock ups of an eight display electronic attitude direction indicator for an airborne integrated display. Displays were presented in digital, analog digital, and analog format to experienced pilots. Two tests were run, one involving the speed of memorization in a single exposure and the other comprising two five second exposures spaced 30 sec apart. Errors increased with the speed of memorization. Generally, the analog information was assimilated faster than the digital data, with regard to the response speed. Information processing was quantified as 25 bits for the first five second exposure and 15 bits during the second. D.H.K. (IAA)

**N84-15790#** Hawaii Univ, Manoa  
**INFLUENCES ON GROUP PRODUCTIVITY. 2: FACTORS INHERENT IN THE PERSON. A BIBLIOGRAPHIC SYNOPSIS Interim Report**

S. OSATO, P E CAMPOS, N GOODMAN (St Peters College), and D. LANDIS (Indiana Univ - Purdue Univ) 15 Jul 1983 62 p refs  
 (Contract N00014-83-K-0021)  
 (AD-A131015, CARE-83-3) Avail NTIS HC A04/MF A01  
 CSCL 05J

The present summary examines the effects of heterogeneity on a group's productivity. Heterogeneity has been defined on many different dimensions without much consistency between workers. For the sake of clarity, we have grouped the studies by the type of variable used to define heterogeneity: personality variables or sociodemographic variables. In all the studies surveyed, these different variables have served as the independent dimension. GRA

**N84-15791#** Educational Testing Service, Princeton, N J  
**COMPARISON OF IRT OBSERVED-SCORE AND TRUE-SCORE EQUATING**

F M LORD and M S WINGERSKY Jul 1983 14 p  
 (Contract N00014-80-C-0402)  
 (AD-A133871, ETS-RR-83-26-ONR) Avail NTIS HCA02/MFA01  
 CSCL 05J

Two methods of 'equating' tests using item response theory are compared, one using true scores, the other using estimated observed scores. On the data studied, they yield almost indistinguishable results. This is a reassuring result for users of IRT equating methods. Author (GRA)

**N84-15792#** Massachusetts Inst of Tech, Cambridge Artificial Intelligence Lab  
**VISUAL ROUTINES**

S. ULLMAN Jun 1983 68 p  
 (Contract N00014-80-C-0505, NSF MCS-79-23110)  
 (AD-A133634, AI-M-723) Avail NTIS HCA04/MFA01  
 CSCL 05J

This paper examines the processing of visual information beyond the creation of the early representations. A fundamental requirement at this level is the capacity to establish visually abstract shape properties and spatial relations. This capacity plays a major role in object recognition, visually guided manipulation, and more abstract visual thinking. The proficiency of the human system in analyzing spatial information far surpasses the capacities of current artificial systems. The study of the computations that underlie this competence may therefore lead to the development of new more efficient processors for the spatial analysis of visual information. It is suggested that the perception of spatial relations is achieved by the application to the base representations of visual routines that are composed of sequences of elemental operations. Routines for different properties and relations share elemental operations. Using a fixed set of basic operations, the visual system can assemble different routines to extract an unbounded variety of shape properties and spatial relations. A number of plausible basic operations are suggested, based primarily on their potential usefulness, and supported in part by empirical evidence. The operations discussed include shifting of the processing focus, indexing to an odd-man-out location, bounded activation, boundary tracing, and marking. The problem of assembling such elemental operations into meaningful visual routines is discussed briefly. GRA

**N84-15793#** Federal Aviation Administration, Oklahoma City, Okla Civil Aeromedical Inst

**JOB ATTITUDES TOWARD THE NEW MAINTENANCE CONCEPT OF THE AIRWAY FACILITIES SERVICE**

D J SCHROEDER and J R DELONEY Feb 1983 82 p  
 (AD-A133282, FAA-AM-83-7) Avail NTIS HCA05/MFA01  
 CSCL 05I

To determine the attitudes of Airway Facilities (AF) personnel to the proposed New Maintenance Concept (NMC), an extensive

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questionnaire was mailed to all employees. Of 11,569 questionnaires distributed, 6,976 were completed and returned. Responses to the NMC questions were analyzed with respect to employee characteristics, job satisfaction measures, shift work, and general health variables. This report summarizes the findings from the NMC questionnaire and provides a technical documentation of the completed study. However, regular consultation with Airway Facilities Service (AAF) officials was conducted throughout the data analyses period for use in management decisions regarding this developing concept. Also, although the functions of AAF were formally assumed by the Systems Engineering Service (AES) and Program Engineering and Maintenance Service (APM) in a reorganization effective October 4, 1982, the older designation (AAF) will be used throughout this report. GRA

**N84-15794#** Ben Gurion Univ of the Negev, Beersheva (Israel)  
Dept of Behavioral Sciences

**A COMPARISON OF MAP LEARNING METHODS: MAP STUDY, SIMULATED TRAVEL AND MIXED** Final Report, 15 Sep. 1981 - 14 Mar. 1983

D LEISER 1 Jun 1983 42 p Presented at Israel Ergonomics Soc Conf, 1983

(Contract AF-AFOSR-0244-81, AF PROJ 2301)  
(AD-A133544, EOARD-TR-83-14) Avail NTIS HCA03/MFA01  
CSCL 08B

Two main methods of studying spatial networks were compared: travel in the network, using a computer simulation, and study of a map of the network. Subjects were tested on their ability to demonstrate efficient routes between points on the network, using the same computer simulation. Study times, efficiency of the routes and time characteristics of the performance were recorded. Findings include: latency before beginning a simulated travel increases with the origin-goal distance in map condition, but not in travel condition. In travel, latencies are shorter, but study times longer than with the map method. Variants of the basic methods were also studied. It was concluded that variations in the study methods affect study time and performance characteristics. Innovative study methods may produce significant improvement in the performance, especially if care is taken to match study method, spatial task required, and individual characteristics. GRA

**N84-15795#** Federal Aviation Administration, Washington, D C  
Office of Aviation Medicine

**RATE OF INITIAL RECOVERY AND SUBSEQUENT RADAR MONITORING PERFORMANCE FOLLOWING A SIMULATED EMERGENCY INVOLVING STARTLE**

R I THACKRAY and R M TOUCHSTONE Sep 1983 22 p  
(AD-A133602, FAA-AM-83-13) Avail NTIS HCA02/MFA01  
CSCL 05J

The present study employed auditory startle to simulate the principal components (unexpectedness, fear, and physiological arousal) that are common to many types of sudden emergencies and compared performance recovery following startle with recovery following a nonstartling stimulus. The subject's primary task was to monitor a simulated air traffic control radar display. Performance recovery following the emergency (a radar failure signaled by either a loud or low level noise) was assessed in terms of response time and error rate on a secondary information processing (serial reaction) task and also in terms of subsequent performance on the radar monitoring task. Although the high intensity noise was clearly startling, while subjects exposed to the lower intensity noise showed only a surprise reaction, subsequent performance of the two noise exposure groups differed significantly in only two respects. The variance of initial response times was greater in the startled group, and this group had a higher frequency of incorrect responses on the serial reaction task during the first minute following stimulation. A comparison of these findings with those of other studies of simulated emergencies suggests that recovery time for simple perceptual-motor responses during the initial shock phase of an emergency is quite rapid (on the order of 1 to 3 s), and this appears to be independent of whether or not the emergency is startling and emotionally arousing or simply

surprising and unexpected. If the shock phase evokes heightened emotional-physiological arousal as in the case of startle, information-processing ability may be impaired for approximately 30 to 60 s following the stimulus event. GRA

**N84-15796#** Army Training Development Inst, Fort Monroe, Va  
**EVALUATION RESULTS FOR THE INTERACTIVE VIDEO COMPETENCY RECOGNITION SYSTEM** Final Report, Dec. 1982 - Mar. 1983

R AVANT, C A JOHNSON, and P BEST 30 May 1983 114 p  
(AD-A133052, TDI-TR-83-4) Avail NTIS HCA06/MFA01  
CSCL 05I

The Organizational Effectiveness Center and School (OEC/S) at Ft Ord, CA, has been the training center for the Army's Organizational Effectiveness Consultants since 1975. The effectiveness of such consultants appears to be dependent upon soft skills: interpersonal competencies, rather than specific tasks which are performed. In 1979, OEC/S and the Army Research Institute contracted with McBer and Co. to develop a model of the competencies which distinguish the superior from the average consultant. Eighteen of the 33 competencies identified in the McBer model were considered by OEC/S to be potentially trainable in the course. The success of the training requires an understanding of the competencies and an ability, on the part of the trainers, to recognize if and when the competencies are being demonstrated. Author (GRA)

**N84-15797#** Office of Naval Research, London (England)  
**APPLIED PSYCHOLOGY IN EUROPE: AN ONR PERSPECTIVE** Assessment Report

N A BOND, JR 27 Jul 1983 9 p  
(AD-A133093, ONRL-R-7-83) Avail NTIS HCA02/MFA01  
CSCL 05J

This report is intended to alert American researchers to European developments in applied psychology. The following areas are examined: interactive man-machine interfaces, combat reactions and stress, memory enhancement, large digital simulators, and human performance models. GRA

**N84-15798#** National Aerospace Lab, Amsterdam (Netherlands)  
Flight Div

**HUMAN VISUAL INFORMATION PROCESSING: BASIC VIEWPOINTS FROM PSYCHOLOGY AND HUMAN ENGINEERING RESEARCH**

R C VANDEGRAAFF and P H WEWERINKE 14 Jun 1982 15 p refs Presented at 2nd European Conf on Human Decision Making and Manual Control, Bonn, 2-4 Jun 1982. Revised (NLR-MP-82032-U) Avail NTIS HC A02/MF A01

The constructivist-cognitive approach and human engineering model approach to human visual perception are compared. A multivariable decision making experiment on the engineering model is summarized. Psychological models hypothesize that conceptual knowledge determines the perceptual experience, or that perception is directly dictated by visual stimuli. The human engineering approach is that the information processing involves estimation of the environment which has to be perceived. The momentary perceived environment is compared with an expectation of its state (which has to be generated by the observer). The outcome of the comparison is the essential information (innovation), used for further processing. Engineering model predictions of detection of abnormal operation of a dynamic process agree closely with measurements ( $r = 0.86$ ). Author (ESA)

## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering, biotechnology, and space suits and protective clothing.

**A84-16343**

### ELECTROCUTANEOUS STIMULATION WITH HIGH VOLTAGE CAPACITIVE DISCHARGES

J P REILLY (Johns Hopkins University, Laurel, MD) and W D LARKIN (Maryland, University, College Park, MD) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol BME-30, Oct 1983, p 631-641 Research supported by the Maryland Department of Natural Resources and Canadian Electrical Association refs

This paper presents research on the sensory and electrical properties of human subjects in response to electrical stimuli from high-voltage capacitive discharges Threshold data for single monophasic transient stimuli are analyzed The psychophysical measurements are related to a neuroelectric model with parameters that depend on some of the basic properties of excitable membranes

Author

**A84-16368**

### MANUAL CONTROL OF THE LINE OF SIGHT IN OPTICAL SYSTEMS

M H MEHR (Measurement Systems, Inc., Norwalk, CT) IN Optical systems engineering III, Proceedings of the Conference, Los Angeles, CA, January 20, 21, 1983 Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p 127-133 refs

This paper discusses the human factors or ergonomic considerations related to the manual control of an optical line of sight The general concept of the human operator as an element in the servo loop is presented, along with some examples of how this concept has been used in the design of optical tracking devices 'Aided Tracking' is described Comparisons are made between commonly used force and displacement joysticks

Author

**A84-16620**

### FLIGHT SIMULATION CUE SYNCHRONIZATION

B J WOYCECHOWSKY (Singer Co., Link Flight Simulation Div., Binghamton, NY) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983. Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 740-745

This paper addresses problems associated with reproducing flight cues in a flight simulator in a manner which provides sufficient realism for effective training Left unattended during the design process, the time delays associated with simulated cues will not match those in the actual aircraft, since in the simulator the controls interface with a digital (or analog) computational system which computes aircraft performance, while in the aircraft the controls interface with the actual aircraft control system and the real world environment Therefore, care must be taken in the design of flights simulators to ensure that flight simulator cues have time delays which are reasonably consistent with those experienced in the actual aircraft This paper discusses a proposed approach to the specification of aircraft simulator dynamic response, factors which should be considered in matching flight simulator dynamic response to actual aircraft dynamic response, and flight simulator cue synchronization design considerations

Author

**A84-16621#**

### WIDE FIELD-OF-VIEW VISUAL DISPLAY TECHNOLOGY FOR FLIGHT SIMULATION

H E GELTMACHER and J C SEAT (USAF, Human Resources Laboratory, Williams AFB, AZ) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 746-753 refs

Current wide field-of-view visual display systems deliver inadequate brightness and resolution necessary for advanced combat simulation The Air Force Human Resources Laboratory is developing display technologies to solve this problem These technologies are examined and compared with those incorporated in existing visual display systems This includes descriptions, advantages, and limitations of solid and liquid crystal light valves, fiber optic helmet mounted displays, light collimating techniques, and stereoscopic viewing techniques A review of human eye requirements and the deficiencies in current systems is presented Trends on the direction of display technology for simulators are evaluated

Author

**A84-16622**

### TRADEOFFS IN THE IMPLEMENTATION OF LOCAL ILLUMINATION SOURCES IN THE REAL-TIME DISPLAY OF A VISUAL SCENE

T L SMITH (Singer Co., Link Flight Simulation Div., Sunnyvale, CA) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 754-759 refs

This paper presents an examination of tradeoffs involved in the choice of a method for implementing the display of a local illumination source in the real-time simulation of a visual scene Attention is generally restricted to the problem of simulating a single white illumination source in a raster-scan system The tradeoff analysis involves the estimation of the relative complexities of the software, hardware, and visual database as the method of implementation moves from (1) inclusion in the database itself to (2) real-time manipulation of database elements to (3) manipulation of visual elements in the image generation hardware It is assumed throughout that a visual database is of the hierarchical object-face-edge-vertex form Finally, the tradeoff analysis is reexamined with respect to the problems associated with the presentation of illumination sources which are (1) more than one in number, (2) dynamic with respect to either position or intensity, and (3) colored

Author

**A84-16623#**

### THE C-130 VISUAL SYSTEM - AN UPDATE

R G SPEER (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983. Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 769-775

In 1978, the Air Force awarded a contract for the development of a computer image generation (CIG) visual system for the C-130E Weapon System Trainer (WST) The image generator was to be the most sophisticated CIG visual system ever built It was intended to build a system which could provide C-130 aircrews with a realistic training related to ground operation, low level navigation, tactical airdrop, assault landing, takeoff, approach and landing, and operations during day, dusk, night, and various weather conditions The major components of the visual system include the computer image generation system, the display system, the data base, the instructor control subsystem, and the Development Engineering Prototype Site (DEPS)

G R

**A84-16659**

### **PICTORIAL FORMAT DISPLAY EVALUATION**

J S HAWKINS, J M REISING (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH), and J D GILMOUR (Boeing Military Airplane Co., Seattle, WA) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1132-1138 refs

Current fighters use monochrome cathode ray tubes (CRTs) to display aircraft status or flight information. The Boeing 757 and 767 jetliners and the Airbus A310 use color CRT displays, and the military services are buying full color CRTs for aircraft. The widespread use of CRT displays in future cockpits is a fact. How can these revolutionary display mechanisms be best used? This paper discusses a simulation designed to evaluate full color, computer-generated imagery formats for six kinds of displays: flight, tactical situations, stores, emergency conditions, systems status, and engines. It is the first of several simulation studies planned to examine various missions and aircraft types. Results indicate these formats can present highly complex data in an intuitive manner which observers can process efficiently. Further investigations will be aimed at refining specialized formats for specific mission applications. Author

**A84-16660#**

### **RESEARCH REQUIREMENTS FOR ADVANCED AIRCREW 3-D DISPLAYS**

K R BOFF and G L CALHOUN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1139-1146 refs  
(Contract F33615-82-C-0511)

Owing to the greater use of digital computers in avionics subsystems, more information can be made available to the pilot. It is noted that conventional display techniques, coupled with these larger amounts of data, may tax the pilot's ability to perceive, interpret, and react to the information. Stereoscopic devices that permit a three-dimensional portrayal of information may increase pilot efficiency and system capability by taking advantage of the human's highly refined and well practiced sense of depth, which is not used when viewing conventional two-dimensional displays. The research program and facilities of the Human Engineering Division of the Air Force Aerospace Medical Research Laboratory are described insofar as they relate to current investigations of requirements for three-dimensional displays. C R

**A84-16662#**

### **SMART STICK CONTROLLERS IN AN ACCELERATION ENVIRONMENT**

D W REPPERGER and J W FRAZIER (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1154-1161 refs

In the side force maneuvering vehicles, the lateral G field (Gy) may produce undesirable biodynamic effects on the pilot's body which will influence the manner in which the pilot utilizes the controllers in the aircraft. Four designs based on different criteria are suggested here for a computer-controlled side stick: a vibration-isolation design, a circuit model, a negative biomechanical stick, and a minimum workload stick. The computer changes the dynamic characteristics of the stick based on one of the four possible designs; the design can be chosen for the objectives of the mission. Two forms of biomechanical feedthrough are defined, and it is shown that negative biomechanical feedthrough improves tracking performance under Gy conditions. V L

**A84-16664**

### **CARDIOVASCULAR RESPONSES DURING SYSTEMATIC VARIATION OF HEADGEAR LOADING PARAMETERS**

D B REYNOLDS, C A PHILLIPS, J S PETROFSKY, H H HEATON, III, and D M HENDERSHOT (Wright State University, Dayton, OH) IN NAECON 1983, Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 17-19, 1983 Volume 2 New York, Institute of Electrical and Electronics Engineers, 1983, p 1200-1209 refs

Experiments carried out to quantify the stress and fatigue of neck muscles, as measured by cardiovascular responses, are described. The muscles were loaded statically and dynamically through a systematic variation of fifteen headgear configurations. These comprised five different combinations of center of gravity and three different weights. The subjects rotated their heads laterally (from side to side) for 30 minutes in each of the 15 headgear loading combinations. Immediately thereafter, the subject placed his head in an isometric head dynamometer and exerted a sustained right lateral neck contraction or forward neck contraction at 70 percent of his maximum strength. During this, the systolic and diastolic blood pressures rose by an average of 40 percent and the heart rate increased by an average of 20 percent. The results confirm a significant cardiovascular response associated with fatiguing isometric neck muscle contractions. C R

**A84-16699**

### **EVALUATING NEW CONCEPTS FOR AIRCREW ALERTING**

B L BERNSON (Lockheed-California Co., Burbank, CA) Lockheed Horizons, no 14, 1983, p 20-26

An experimental study was conducted to evaluate whether the addition of a time-critical display could facilitate a pilot's response to emergency situations, and, if so, to determine what combination of display parameters would help pilot performance. A visual flight simulator with a separate display for time-critical warnings was used to study four principal design variables. The data obtained indicated that a time-critical display would enable a pilot to respond to an emergency within the required response envelope. Best pilot performance was obtained when graphic guidance information was presented in the pilot's primary field of view. Graphic displays should be used, though with carefully developed formats, and with any alphanumeric located to the right of the graphics. It was determined that the display should provide guidance as opposed to status, information, and that voice messages should be used to express time-critical warnings. J N

**A84-17013**

### **SOME COMPARISONS OF ON-DISPLAY AND OFF-DISPLAY TOUCH INPUT DEVICES FOR INTERACTION WITH COMPUTER GENERATED DISPLAYS**

D WHITFIELD, J M BIRD (Aston, University, Birmingham, England), and R G BALL (Royal Signals and Radar Establishment, Malvern, Worcs., England) Ergonomics (ISSN 0014-0139), vol 26, Nov 1983, p 1033-1053. Research sponsored by the Civil Aviation Authority of England. refs

The relative merits of on-display and off-display touch input devices are discussed, together with the additional features of computer-generated feedback and the means of confirming a selection. Subjects' performances with on-display and off-display devices are compared in three experiments with increasing target resolution requirements - menu selection, tabular display, and target acquisition. Performance, and subjective reactions, appear to be no worse for the off-display input, although both devices are worse than a rolling ball (tracker ball) for high resolution targets. Characteristic types of error with these devices are demonstrated, and no beneficial effects of enhanced computer-generated feedback are shown. It is concluded that off-display continuous touch input carries no performance penalty over the on-display counterpart, and that its use is justified where its other advantages are apposite. Author

A84-17294

**STUDIES ON THE PROPHYLAXIS OF VIBRATION SICKNESS [OPYT PROFILAKTIKI VIBRATSIONNOI BOLEZNI]**

T M RADZIUKEVICH, A M MIKULINSKII, and A V EPISHIN  
(Gor'kovskii Nauchno-Issledovatel'skii Institut Gигiены Truda i Profzabolevanií, Gor'kovskaya Oblastnaya Sanitarno-Epidemiologicheskaya Stantsiya, Gorki, USSR)  
Zdravookhraneniye Rossiiskoi Federatsii (ISSN 0044-197X), no 7, 1983, p 34-36 In Russian

A84-17856#

**DESIGN AND TESTING OF AN ADVANCED PRESSURE SUIT GLOVE**

M CLAPP (MIT, Cambridge, MA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan 9-12, 1984 9 p refs  
(AIAA PAPER 84-0067)

A lightweight pressure suit glove, made of an elastic material, was designed and constructed to apply a mechanical counterpressure to the human hand equal to the pressure of the air that a human would breathe in a conventional pressure suit. An interface was also built, allowing the lightweight glove called a skinsuit glove, to mechanically pressurize the hand in a partial-vacuum chamber while the rest of the body remained exposed to normal atmosphere conditions. The skinsuit glove allowed the hand to be more mobile and dextrous than did a conventional pressure suit glove from an Apollo A7L-B pressure suit. The skinsuit glove also afforded better tactile feedback than an A7L-B glove, and was less fatiguing to wear. Adverse health effects on the hand due to exposure of the human skin to partial vacuum were not observed. Author

A84-18162#

**DIGITAL HEAD TRACKING AND POSITION PREDICTION FOR HELMET MOUNTED VISUAL DISPLAY SYSTEMS**

B R SMITH, JR. (Singer Co., Link Flight Simulation Div., Binghamton, NY; USAF, Human Resources Laboratory, Williams AFB, AZ) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan 9-12, 1984 10 p refs  
(AIAA PAPER 84-0557)

This report discusses the systems that must be interfaced to define the viewpoint and head orientation for a digital image generator used in flight simulation. The digital position and attitude information is used to predict ahead to compensate for the inherent time lags in the system so that a pilot, using a helmet mounted visual display, can see what is in front of him in real time. The report includes the limitations and assumptions made with each system and then the approach taken by the author to determine the interface algorithm used. Although this study is tailored to the hardware used in a specific application, much of the final data can be applied to other systems if properly modified. Author

A84-18572

**MATHEMATICAL MODEL FOR VESTIBULO-OCULAR REFLEX**

Z SI-LAN (Beijing Medical College, Beijing, People's Republic of China), Y LI-SHEN (Institute of Aviation Medicine, People's Republic of China), L KE-QIU, and Q GAO-XI (Beijing University, Beijing, People's Republic of China) IN Identification and system parameter estimation 1982, Proceedings of the Sixth Symposium, Washington, DC, June 7-11, 1982 Volume 1 Oxford and New York, Pergamon Press, 1983, p 307-311 refs

A mathematical model for vestibulo-ocular reflex based on the knowledge of physiology and anatomy has been provided. It is applied to certain patients who suffered from vestibular diseases examined by various vestibular tests and to the normal subjects who revealed different types of vestibular function. According to their post rotational electronystagmography (ENG) their model parameters can be estimated and their traditional parameters can be obtained by system identification and direct measurement respectively. With these parameters, some discriminant functions can be established from the data of the subjects examined. These discriminant functions can be applied to clinical diagnosis of

vestibular diseases and classification of normal vestibular function. Some satisfactory results have been obtained. Author

A84-18589

**EXPERIMENTAL DESIGN OF A MODEL FOR THE DYNAMIC BEHAVIOUR OF PILOT CANDIDATES**

K HENNING, P IJEWSKI, and H RAKE (Aachen, Rheinisch-Westfaelische Technische Hochschule, Aachen, West Germany) IN Identification and system parameter estimation 1982, Proceedings of the Sixth Symposium, Washington, DC, June 7-11, 1982 Volume 1 Oxford and New York, Pergamon Press, 1983, p 621-626 refs

The dynamic behaviour of man in closed two-variable control loops can be approximated satisfactorily by a quasilinear model. For uncoupled systems and the transmission channel eye-hand a data acquisition procedure has been developed, which supplies frequency responses of the human controller. The dynamic behaviour of human controllers has been examined with the aid of a tracking simulator with stochastic disturbances as input signal. The input and output signals have been sampled and recorded by a process computer and evaluated by means of correlation and Fourier analysis on a larger computer system. The results of the evaluations allow conclusions on the capability of pilot candidates to solve manual control tasks. Author

A84-18639

**MODELING AND IDENTIFICATION OF AIRCRAFT PILOT MODELS VIA PARTITIONING ESTIMATION ALGORITHMS**

D ANDRISANI, C F GAU, S M BOURNE (Purdue University, West Lafayette, IN), and D G LAINIOTIS (Patras, University, Patras, Greece) IN Identification and system parameter estimation 1982, Proceedings of the Sixth Symposium, Washington, DC, June 7-11, 1982 Volume 2 Oxford and New York, Pergamon Press, 1983, p 1665-1670 refs  
(Contract N62269-81-C-0729)

Three applications of the partition estimation theorem of Lainiotis, the postulate/evaluate method, the parameter identification using partitioning, and the partitioning of process noise, are presented to estimate such parameters as feedforward control inputs, time delays, and random forcing functions. Mathematical pilot models are determined from transient responses of a pilot hovering a VTOL aircraft over a landing pad which moved in discrete semirandom jumps while the vehicle was flying in the presence of natural turbulence and measured synthetic turbulence. J N

A84-18751

**METHODS OF BIOTELEMETRY [METODY BIOTELEMETRII]**

V P BAKALOV (Leningrad, Izdatel'stvo Nauka, 1983, 176 p. In Russian refs

The basic principles and methods of biotelemetry are discussed in relation to various physiological studies, such as telemetry, telemonitoring, endoradioprobeing, and teletracking. Attention is given to errors and interference in biotelemetry, evaluation of the quality of biotelemetric systems, their classification, and optimization of biotelemetric systems. The functional structure of certain components of these systems, described in terms of general operators, is examined. In particular, the theoretical principles underlying the optimal algorithms for the selection, conversion, transmission, and processing of biotelemetric information are discussed. The discussion also covers some aspects of the telemetry of multidimensional biological parameters and noise suppression techniques. V L

A84-18776

**HUMAN FACTORS SOCIETY, ANNUAL MEETING, 26TH, SEATTLE, WA, OCTOBER 25-29, 1982, PROCEEDINGS**

R E EDWARDS, ED and P TOLIN, ED (Boeing Co., Seattle, WA) Santa Monica, CA, Human Factors Society, 1982, 1033 p

Various aspects of human factors in technology are considered. The topics addressed include training strategies and skill acquisition, industrial ergonomics, warning messages and pictorials, workplace design, designing for the handicapped, human-computer

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interaction through voice technology, computer systems, instrument scanning and workload, human factors research, aircraft displays research, cognitive processes, and physiological and biological research. Also discussed are color in visual displays, workplace assessment methodology, simulation fidelity and new training technology, visual factors in aircrew training, advances in simulation technology, alcohol effects on performance and productivity, research in dynamic manual control, computer-aided human engineering, and visual performance in pilot instrument scanning. C D

**A84-18781**

### **EVALUATION OF CONTROL STATION DESIGN - THE CREW HUMAN ENGINEERING SOFTWARE SYSTEM**

R J JONES, C C YAN (Boeing Computer Services, Inc., Seattle, WA), and G L JONSEN. IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 40-43 refs

Computer simulation techniques are an attractive adjunct to human-subjects testing in the evaluation of the interface between the operators of a complex machine and the control station at which they work. The Crew Human Engineering Software System (CHES) brings together a powerful collection of tools for analyzing both control station geometry and procedure. These tools permit design evaluation to proceed before construction begins, and allow the comparison of many alternative designs across a variety of operating conditions at minimal expense. CHES has made an important contribution to the evaluation of aircraft flightdeck design at Boeing. Author

**A84-18784\*#** George Mason Univ., Fairfax, Va

### **HUMAN FACTORS DIMENSIONS IN THE EVOLUTION OF INCREASINGLY AUTOMATED CONTROL ROOMS FOR NEAR-EARTH SATELLITES**

C M MITCHELL (George Mason University, Fairfax, VA). IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 155-159 refs (Contract NAS5-26852)

The NASA-Goddard Space Flight Center is responsible for the control and ground support for all of NASA's unmanned near-earth satellites. Traditionally, each satellite had its own dedicated mission operations room. In the mid-seventies, an integration of some of these dedicated facilities was begun with the primary objective to reduce costs. In this connection, the Multi-Satellite Operations Control Center (MSOCC) was designed. MSOCC represents currently a labor intensive operation. Recently, Goddard has become increasingly aware of human factors and human-machine interface issues. A summary is provided of some of the attempts to apply human factors considerations in the design of command and control environments. Current and future activities with respect to human factors and systems design are discussed, giving attention to the allocation of tasks between human and computer, and the interface for the human-computer dialogue. G R

**A84-18786#**

### **METHODOLOGY FOR EXPLORING VOICE-INTERACTIVE AVIONICS TASKS OPTIMIZING INTERACTIVE DIALOGUES**

S J MOUNTFORD, R A NORTH, S V METZ (Honeywell Systems and Research Center, Minneapolis, MN), and N WARNER (U.S. Navy, Naval Air Development Center, Warminster, PA). IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 207-211 (Contract N62269-81-R-0344)

Two experiments were performed to investigate the most advantageous format for interactive dialogue between pilots of a fighter aircraft and an on-board voice recognition and synthesis system. A representative task was chosen among those anticipated to be performed using a multi-function display and control system during high workload mission segments. The first experiment compared different methods of progressing through a 'menu driven' sequence using voice I/O. A second experiment was conducted

using the dialogue approach that proved easiest to use in the first experiment, and compared performance of voice I/O vs keyboard-display I/O in timeshared conditions with a simultaneously performed flight control task. Results showed that after an initial training period with voice I/O pilots performed the flight control task with little or no disruption from the voice interactive data entry task, but showed significantly higher degradation when required to use the keyboard system. Author

**A84-18787**

### **HUMAN FACTORS GUIDELINES FOR THE USE OF SYNTHETIC SPEECH DEVICES**

T R EDMAN (Honeywell Technology Strategy Center, Roseville, MN). IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 212-216 refs

A review of the literature on synthetic speech devices is presented, including research on the intelligibility, comprehension and acceptability of synthetic speech, work on the use of synthetic speech in multitask situations, and studies of the function and utility of synthetic speech for alarming and annunciation, and for training and education. Standard human factors references and guides for speech communication are examined for their applicability to modern synthetic speech technologies. J N

**A84-18788#**

### **THE INFLUENCE OF S-C-R COMPATIBILITY AND RESOURCE COMPETITION ON PERFORMANCE OF THREAT EVALUATION AND FAULT DIAGNOSIS**

M VIDULICH and C D WICKENS (Illinois, University, Champaign, IL). IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 223-226 (Contract N00014-79-C-0658)

Stimulus/central processing/response compatibility defines the optimum assignment of tasks to input modalities (auditory, A and visual, V) and output modalities (manual, M and speech, S). Spatial tasks are S-C-R compatible with visual/manual assignments. Verbal tasks are compatible with auditory/speech assignments. Ten subjects time-shared a spatial task of aerial threat evaluation with a verbal task of fault diagnosis. All four i/o modality combinations of the threat task were performed while the fault task was performed with A/M and V/M assignments. The joint effects of compatibility, and competition between tasks for input and output modalities were demonstrated. When resource competition was held constant, the effects of compatibility were found to be enhanced in dual task conditions. When both influences varied they were demonstrated to counteract in certain conditions and balance each other's effect. Author

**A84-18789**

### **THE PERCEPTION OF FLICKER AND GLARE ON COMPUTER CRT DISPLAYS**

S ISENSEE (Kansas State University of Agriculture and Applied Science, Manhattan, KS). IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 281-284 refs

Twenty-one subjects rated their discomfort due to direct glare, reflected glare, and flicker while viewing a CRT display under various conditions of ambient illuminance, video luminance, and video polarity. The angle away from the CRT at which the subjects first noticed flicker was also measured. Levels of these design and environmental variables which minimize discomfort are suggested. Video luminance was shown to have the greatest impact on comfort. Methods of reducing glare and flicker are discussed. Author



**A84-18790****A COMPARISON OF VDT ANTIREFLECTION TREATMENTS**

J. K. HABINEK, P. M. JACOBSON, W. MILLER, and T. W. SUTHER, III (IBM Corp., System Products Div., Rochester, MN) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 285-289 refs

Operators of video display terminals often cite specular screen reflections as a major source of annoyance. The current study used a legibility task to compare the effectiveness of three antireflection treatments: nylon mesh filter, quarter-wavelength thin film coating, and direct surface etching. Performance and preference data revealed very little difference among the three treatments. All were effective relative to an untreated polished glass screen when light sources were deliberately arranged to produce unavoidable screen reflections. Author

**A84-18792#****OPTICAL VARIABLES AS MEASURES OF PERFORMANCE DURING SIMULATED FLIGHT**

D. H. OWEN and R. WARREN (Ohio State University, Columbus, OH) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 312-315 refs  
(Contract F49620-79-C-0070, AF-AFOSR-81-0078)

It is assumed that when a pilot flies according to visual flight reference, control adjustments are made in order to control visual perception. If so, the optical variables and invariants produced by the pilot can serve as dependent variables in research on information used in guiding flight. Visual flight simulators provide an ideal experimental environment for exploring the optical approach to the study of pilots' perception-action cycles. Author

**A84-18795****A STUDY OF DIRECT DISTANCE ESTIMATIONS TO FAMILIAR OBJECTS IN REAL-SPACE, TWO-DIMENSIONAL, AND STEREOGRAPHIC DISPLAYS**

T. M. LIPPERT, D. L. POST, and R. J. BEATON (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 324-328. Research supported by the Virginia Polytechnic Institute and State University.

Stereographic displays are being considered or are under development for a variety of military and civilian applications in which the visual simulation of depth is of prime importance. A study comparing direct distance estimations to familiar objects under impoverished stimulus conditions from a real-space setting and two- and three-dimensional rear-projected color photographic displays was conducted to determine their relative merits in providing absolute depth information. Results indicated similar utility among the displays employed for the experimental task. However, observers rated their confidence in making distance estimations highest for the stereographic display. Some theoretical implications and methodological problems are discussed. Author

**A84-18796#****EVALUATION OF CRT-DISPLAYED DIGITAL IMAGERY USING SUBJECTIVE SCALING**

B. P. CHAO, R. J. BEATON, and H. L. SNYDER (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 329-333 refs  
(Contract F49620-80-C-0057)

Quality judgments of blur and noise image degradation are evaluated by means of a subjective scaling technique, in an investigation of the perceived interpretability of static, digitized monochrome images displayed on CRTs. Each of 10 digital image scenes were degraded by five levels of blurring and five of noise, yielding a set of 250 images for viewing by 15 U.S. Air Force photointerpreters. The interpretability of each image was rated on a 10-point NATO scale. An analysis of the scaling values indicates

that blur, noise, and their interactions, are statistically significant, having a monotonic decrease of perceived image interpretability with image degradation. In separate testing, the photointerpreters extracted information from a selected subset of images, and exhibited a high correlation between scaling values and information. This suggests that information extraction performance can be accurately predicted from subjective quality judgments. O.C.

**A84-18798****PARAMETRIC AND NONPARAMETRIC SIGNAL DETECTION MEASURES - PROS AND CONS**

C. M. BROWN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 344-348 refs

Several signal detection measures are discussed. Their relationships and intercorrelations are presented in an analysis of parametric and nonparametric estimates from a signal detection experiment. It is suggested that, in agreement with the comparisons of Craig (1979), the nonparametric measures A sub G, A-prime and beta-prime can serve as good substitutes for d-prime (signal detection sensitivity) and beta (response criterion). It is concluded that nonparametric measures should be used if there is reason to question the parametric assumptions. J.N.

**A84-18799#****AVERAGED CROSS-CORRELATIONS WITH DIFFERENTIALLY-STABLE VARIABLES - FEWER SUBJECTS REQUIRED WITH REPEATED MEASURES**

A. C. BITTNER, JR. (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA), W. P. DUNLAP (Tulane University, New Orleans, LA), and M. B. JONES (Pennsylvania State University, Hershey, PA) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 349-353. Navy-supported research refs

The results obtained from earlier studies of the efficacy of averaging cross-correlations are generalized. The generalized expression for the efficiency of Fisher-z averaged cross-correlations is evaluated where reliabilities are common but not equal to the cross-correlation and where the numbers of repetitions of each variable may be unequal. The efficiency of estimating unaveraged cross-correlations from the cross-correlations between averages (sums) of variables is then examined by way of simulation. An evaluation is made of the efficacy of averaging correlations by potential users. It is found that averaging correlations between repeated measures can compensate for limited numbers of subjects. The results presented provide a basis for evaluating averaged correlations methodology for experimental applications with very modest subject sample sizes (10 or more). C.R.

**A84-18800****METHODOLOGY AND THE USE OF DUAL AND COMPLEX-TASK PARADIGMS IN HUMAN FACTORS RESEARCH**

P. L. ACKERMAN and C. D. WICKENS (Illinois, University, Champaign, IL) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 354-358 refs

**A84-18801#****THE HUGHES DESIGN ANALYSIS SYSTEM AND INSTRUCTOR WORKLOAD IN OPERATIONAL TRAINERS**

A. D. COHEN (Hughes Aircraft Co., Ground Systems Group, Fullerton, CA) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 364-368  
(Contract N61339-81-C-0029)

Computerized simulator trainers require varying degrees of instructor participation in training exercises and student performance evaluation. An estimation of instructor workload before the system has been fully developed is essential for an effective functional allocation of human and computer capabilities. One approach for estimating operator workload is simulation. The



Hughes Design Analysis System (DAS) is an interactive and graphic simulation package. The present paper describes: (1) how DAS has been used for an instructor workload analysis, (2) the analysis method, (3) the results, and (4) the recommendations given to system designers  
 Author

## A84-18802

### PILOT VISUAL BEHAVIOR AS A FUNCTION OF NAVIGATION AND FLIGHT CONTROL MODES IN THE BOEING 757/767

R E EDWARDS, P TOLIN, and G L JONSEN (Boeing Co., Seattle, WA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 441-445

This report presents data obtained from two line-oriented simulations conducted in the Boeing 757/767 simulators. The purpose of these simulations was to assess the impact of two navigation- and two flight control modes on pilot visual behavior during an entire flight, from takeoff to touchdown. The two navigation modes were the traditional VOR mode, in which a compass rose was presented on the HSI, and the MAP mode, in which a pictorial representation of the airplane's flight path was presented on the HSI. The flight control modes were manual and coupled flight. The results indicated that (a) the electronic map did not alter the basic 'T' scan pattern, (b) the pilots' basic scan pattern did not differ in the two navigation modes when flying manually, (c) pilot scan patterns did vary as a function of flight control condition, with the basic 'T' scan pattern accurately characterizing pilot visual behavior in the manual mode but not in the coupled mode, (d) several visual performance measures were sensitive to changes in flight phase, navigation mode, and flight control mode, and (e) no differences in pilot scan patterns were observed between an EICAS-equipped cockpit and a cockpit with conventional engine instruments  
 Author

## A84-18803#

### COLOR DISPLAY FORMATS IN THE COCKPIT - WHO NEEDS THEM?

J M REISING (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) and G L CALHOUN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 446-449 refs

The evaluation of color computer-generated imagery formats in a realistic environment is necessary in order to establish their operational benefit. Subjective testing data show strong airborne system operator preference for color CRT formats, despite their virtual indistinguishability from black-and-white displays by objective measures. The increasing complexity, dynamic character and possibilities for symbology degradation anticipated for future CRT displays strongly recommend the development of color imagery formats. Attention is given to the effects of a combination of single- and dual-purpose color codes  
 O C

## A84-18804#

### IMPROVED ELECTRONIC WARFARE DISPLAYS FOR ATTACK AIRCRAFT

R J FARRELL, W L ANDRES, and J D GILMOUR (Boeing Co., Seattle, WA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 450-454 (Contract N60530-80-C-0230)

The goal of this study was to develop improved concepts for the processing and display of electronic warfare (EW) information to the crew of Navy attack aircraft. The study was crew oriented in that the emphasis was on what information the aircrew needs to respond most effectively to EW threats and how this information might be displayed for most effective use by the aircrew. The study involved four activities: (1) identification and review of EW threat characteristics and threat warning sensor capability, (2) determination of what information about EW threats is needed by aircrews, (3) development and evaluation of several candidate display concepts, and (4) utilization of the results of the previous

three activities to evolve two display concepts and associated information processing algorithms for future simulator evaluation  
 Author

## A84-18805#

### IMAGE INTERPRETATION FOR SOFT-COPY DISPLAYS OF DIGITALLY DERIVED IMAGES

R J BEATON, B P CHAO, and H L SNYDER (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 461-464

(Contract F49620-75-C-0055)

The effects of manipulating image noise and image blur were determined on an information extraction task using soft-copy displays. The participants in this study were 15 military photointerpreters from Langley Air Force Base, VA. The empirical findings indicated that the main effect of image noise was statistically significant ( $p$  less than 0.002) as was the main effect of image blur ( $p = 0.060$ ). The noise by blur interaction was not statistically significant ( $p = 0.872$ ). In general, image interpretation performance decreased with increasing image noise and image blur levels  
 Author

## A84-18810

### THE EFFECT OF ALTITUDE ON ABSOLUTE HEARING THRESHOLD LEVELS

I B MEKJAVIC, D SINCLAIR, D STEELE (Simon Fraser University, Burnaby, British Columbia, Canada), and N S LONGRIDGE (British Columbia, University, Vancouver, Canada) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 488-492 refs

The present study investigates the effect of hypobaric environments on absolute hearing thresholds for pure tones at octave frequencies between 250 Hz and 8 kHz. Absolute hearing thresholds were obtained for ten subjects at ambient pressure (732 mmHg) and at an altitude of 6500 feet (582 mmHg), relative to the laboratory. Subjects were decompressed in a hypobaric chamber at a rate of 500 ft/min and were subjected to the low pressure environment for one hour before being compressed to a normobaric environment, at a rate of 300 ft/min. Absolute hearing threshold levels obtained at altitude, after the one hour exposure to the hypobaric ambient and on descent to normobaric conditions, were compared with scores obtained prior to the hypobaric exposure. In order to compare the frequency averaged threshold shifts at octave frequencies of 250 Hz, 500 Hz and 1 kHz, for the altitude and normobaric conditions, the audiometer was calibrated at ambient pressures of 732, 582 and 512 mmHg. The results of the study indicate a slight increase in sensitivity of the audiometer headphones with altitude and an insignificant difference between the mean frequency averaged threshold shifts for the pre-exposure test and the three experimental conditions (at the onset of hypobaria, after a one hour exposure to the altitude and on descent to surface)  
 Author

## A84-18811

### PHYSIOLOGICAL EFFECT OF PARTIAL SPECTRUM LIGHTING ON THE HUMAN

D A ZABCIK and S B HOTTMAN (Texas A & M University, College Station, TX) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 530-532 refs

An investigation is undertaken of physiological activity changes as a function of partial photic spectrum input to human subjects. The activities tested were grip strength, dexterity, and reaction time, and the independent variables were blue, red, and tungsten filament white lights. Randomization of experimental conditions was used in order to average out all factors not accounted for in the experiment's design. An analysis of test results offers no basis for the rejection of the null hypothesis that the three light sources had no effect on psychomotor skills, strength, or continuous control tasks  
 O C

**A84-18812#****A METHODOLOGICAL INVESTIGATION OF SUBJECT INPUT/OUTPUT RELATED ERROR DURING VIBRATION.**

J C WOLDSTAD, A C BITTNER, JR, and J C. GUIGNARD (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 533-537 Navy-supported research refs

An auditory-input/keypad-output system was evaluated for use as a performance test system that would be independent of artifactual vibrational decrement Six young navy volunteers were administered a non-cognitive auditory response task before, during, and after whole-body sinusoidal vibration Two were tested at each of three vibration conditions (8 Hz/0.21 g(z)rms, 16 Hz/0.43 g(z)rms, and 32 Hz/0.85 g(z)rms) Results showed no direct decrement due to vibration, but a moderately significant subjects-within-conditions by frequency interaction This interaction, paired with subjective measures taken during experimentation, pointed to a deficit in the keypad output system It was concluded that the system was not satisfactory for future experimentation and recommended that a modified input system be developed

Author

**A84-18814****DEVELOPMENT OF A HUMAN ATLAS OF STRENGTHS**

H A HAFEZ, C F. GIDCUMB, M J REEDER, M Y BESHIR, and M M AYOUB (Texas Tech University, Lubbock, TX) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 575-579. Research supported by the Douglas Aircraft Co and Andrus Research Corp refs

Male and female samples of 25 college students each were assessed for dynamic and static maximal strengths at five body joints (elbow, shoulder, lower back, hip, and knee) in order to compile values for an atlas of operator strengths At the static, 5 rpm, and 25 rpm speeds of the tests, torque exertions began at different positions and covered a specified motion range for dynamic measurements Study results are discussed OC

**A84-18815#****EXPRESSIONS OF COLOR CONTRAST AS EQUIVALENT ACHROMATIC CONTRAST**

D L POST, E B COSTANZA, and T M LIPPERT (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 581-585 refs (Contract N00014-78-C-0238)

Designers of color displays have no simple means to relate suprathreshold color contrast to performance because few of the requisite experiments have been performed This situation might be alleviated if there were some means to re-express color contrast in terms of an equivalent achromatic contrast, because this would make relevant the extensive literature relating the latter to performance A pair of experiments was conducted to explore and compare the relationships between color contrast, as represented by three uniform color spaces, and achromatic contrast The results suggest that a satisfactory transformation can be derived, although additional research will be needed to accomplish this

Author

**A84-18816****REDUNDANCY IN CODING OF A VISUAL DISPLAY AS ASSESSED BY A SIGNAL DETECTION PARADIGM**

L J NAJJAR, M J PATTERSON, and G M. CORSO (Georgia Institute of Technology, Atlanta, GA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 586-588 refs

A signal detection paradigm was applied to performance of a visual search task under varying degrees of shape-color redundant coding and two levels of practice The coding conditions were (1)

Black and White, (2) Totally Nonredundant, (3) Partially Redundant, and (4) Totally Redundant. In addition to the traditional signal detection measures, subjective coding condition preference ratings were also recorded Generally, the objective performance measures were influenced by practice However, neither the objective nor the subjective measures were affected by coding conditions A significant Coding Condition by Practice interaction on the percentage of correct responses was also found.

Author

**A84-18818#****TACTICAL GROUND ATTACK - ON THE TRANSFER OF TRAINING FROM FLIGHT SIMULATOR TO OPERATIONAL RED FLAG RANGE EXERCISE**

R HUGHES, R BROOKS, D GRAHAM, R SHEEN, and T DICKENS (USAF, Human Resources Laboratory, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 596-600

A-10 pilots who rehearsed surface attack skills under high threat conditions in a flight simulator survived a significantly higher proportion of total RED FLAG missions than did pilots who did not receive the simulator training These data support the notion that simulator training may have a significant influence upon aircrew survivability in high density ground threat environments

Author

**A84-18820****COMPANION TRAINER AIRCRAFT - ASPECTS OF DUAL QUALIFICATION**

T H KILLION (Dayton, University, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 605-609

The use of a secondary aircraft for providing a part of the continuation training for B-52 crew members has been considered A low cost business jet would serve as 'Companion Trainer Aircraft' (CTA) Two major assumptions are involved in the use of a CTA The first is that secondary aircraft training will transfer positively to the primary aircraft Secondly, it is assumed that the aircrew can attain and maintain proficiency in the second aircraft The present investigation is concerned with this second assumption A test was conducted with eight crews having experience levels which were generally representative of the overall B-52 crew force The results of this test provide some indication of the process and problems of skill acquisition in a secondary aircraft Conclusions are limited because of the limited duration of the test

GR

**A84-18821#****COMPANION TRAINER AIRCRAFT - CONCEPT DEFINITION AND EVALUATION**

R T NULLMEYER (USAF, Human Resources Laboratory, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 610-614 refs

Attention is given to the design requirements, and evaluation of the B-52 flight training-supplementing T-39B Companion Trainer Aircraft (CTA) concept This modified, low cost business jet was to have provided training for the full B-52 crew complement, including the radar navigator, navigator, and electronic warfare officer, in addition to pilot and copilot The T-39B cockpit instrumentation was arranged to duplicate to the greatest possible extent the visual scan patterns of the primary instruments used on the B-52

OC

**A84-18822#****KEYING LOGICS FOR ALPHANUMERIC KEYBOARDS AND HUMAN PERFORMANCE**

L C BUTTERBAUGH (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 634-638 refs

Four keying logics for the entry of alphanumeric characters were evaluated for keying speed and accuracy. The logics were

selected based on their compatibility with current keyboard designs being used for the pilot-aircraft interface with communication, navigation, and other aircraft subsystems. A logic utilizing individual keys (36) for alphanumeric character keying was significantly faster than three other logics which used push-button matrix (telephone) keyboards. All logics were equally accurate, with an error rate of approximately 5 percent. Significant performance differences among the three matrix keyboard logics were inconsistent.

Author

#### A84-18825#

##### **STANDARDIZED TESTS FOR THE EVALUATION AND CLASSIFICATION OF WORKLOAD METRICS**

C A SHINGLEDECKER (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH), M S CRABTREE, and W H ACTON (Systems Research Laboratories, Inc., Dayton, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 648-651 refs

The development of advanced airborne military systems capable of performing increasingly complex missions has led to a situation in which system effectiveness may be compromised by the relatively limited capabilities of human operators. It becomes, therefore, necessary to take into account, in the design process, the workload which would be imposed on the human operator. There arises consequently a growing requirement for a general workload assessment methodology. In order to devise a standardized workload assessment technology for Air Force systems, a program has been initiated to develop a workload metric evaluation methodology. Attention is given to metric evaluation criteria, the criterion task set, aspects of task selection, perceptual input tasks, central processing tasks, decision, and motor output task. G R

#### A84-18826#

##### **TRANSIENT EVOKED POTENTIAL AND EYE MOVEMENT RECORDINGS DURING SIMULATED EMERGENCIES**

G F WILSON (Wittenberg University, Springfield, OH) and R D O'DONNELL (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 652, 653

In order to test pilots' reactions to emergency conditions while flying a motion based simulator brain evoked potentials and eye movements were recorded. Several emergency situations were individually presented to the pilots at critical points of their missions. The pilots responded quickly to each type of emergency. The eye movements showed that the pilots very efficiently responded to the emergencies with their gaze patterns. The evoked response data supported this finding.

Author

#### A84-18827#

##### **NEW TECHNOLOGY FOR TRAINING - AN EVALUATION OF THE AIR CONTROLLER EXERCISER (ACE)**

M E MCCAULEY, R W ROOT, and F A MUCKLER (Canyon Research Group, Inc., Westlake Village, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 758-762

(Contract N61339-81-C-0055)

This paper describes the evaluation of an experimental prototype training system called the Air Controller Exerciser (ACE). The system was developed to demonstrate the use of new technologies for training including computer speech recognition and generation, videodisc, automated instruction, automated performance measurement, syllabus control, and speech-interactive simulation. Empirical studies were conducted to determine the accuracy of the speech recognition system, validate the performance measurement system, and compare ACE with the traditional training program with a transfer of training test. ACE reasonably showed the potential for the use of new technologies in training. However, a number of changes and improvements would be necessary before ACE would be acceptable as an operational training system.

Author

#### A84-18828

##### **USER-COMPUTER INTERFACE DESIGN OF A COMPLEX TACTICAL DISPLAY TERMINAL**

G I DAVIS and W S BADGER (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 768-771

The role of the user-computer interface becomes increasingly important with the growing complexity of command, control, and information systems. Requirements related to the effective integration of human factors design principles in automated command, control, and information systems are examined, taking into account the determination of the basic user-computer task allocation, the determination of the specifics of the user-computer interface, and an analysis of the overall effectiveness of the interface. Attention is given to aspects of design implementation, and design applications.

Author

A84-18829\*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

##### **EFFECT OF PERCEIVED THREAT ON AVOIDANCE MANEUVERS SELECTED WHILE VIEWING COCKPIT TRAFFIC DISPLAYS**

J D SMITH and S R ELLIS (NASA, Ames Research Center, Moffett Field, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 772-776 refs (Contract NCC2-86)

Ten airline pilots rated the collision danger of air traffic presented on cockpit displays of traffic information (CDTI) while they monitored simulated departures from Denver. They selected avoidance maneuvers when necessary for separation. Most evasive maneuvers were turns rather than vertical maneuvers. Evasive maneuvers chosen for encounters with low or moderate perceived collision danger were generally toward the intruding aircraft. This tendency lessened as the perceived threat level increased. In the highest threat situations pilots turned toward the intruder only at chance levels. Some of the implications of the pilots' turning-towards tendencies are discussed with respect to automatic collision avoidance systems and coordination of avoidance maneuvers of conflicting aircraft.

Author

A84-18830\*# Tufts Univ., Medford, Mass

##### **FACILITY REQUIREMENTS FOR COCKPIT TRAFFIC DISPLAY RESEARCH**

S L CHAPPELL (Computer Sciences Corp., Moffett Field, CA) and J G KREIFELDT (Tufts University, Medford, MA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 777-781

(Contract NSG-2156)

It is pointed out that much research is being conducted regarding the use of a cockpit display of traffic information (CDTI) for safe and efficient air traffic flow. A CDTI is a graphic display which shows the pilot the position of other aircraft relative to his or her aircraft. The present investigation is concerned with the facility requirements for the CDTI research. The facilities currently used for this research vary in fidelity from one CDTI-equipped simulator with computer-generated traffic, to four simulators with autopilot-like controls, all having a CDTI. Three groups of subjects were employed in the conducted study. Each of the groups included one controller, and three airline and four general aviation pilots.

G R

**A84-18831#****FLIGHT OPERATIONS SAFETY MONITORING EFFECTS ON THE CREW ALERTING SYSTEM**

D C HANSON, G P BOUCEK, W D SMITH (Boeing Commercial Airplane Co., Seattle, WA), S F CHIKOS (Douglas Aircraft Co., Long Beach, CA), J F HENDRICKSON (FAA, Washington, DC), W W HOWISON, and B L BERSON (Lockheed-California Co., Burbank, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 783-787 Sponsorship U.S. Department of Transportation  
(Contract DOT-FA79WA-4268)

The FAA has begun a study for the development of design guidelines for aircraft alerting systems in the technology generation beyond that of the 757/767 airliners. Preliminary experimentation led to the selection of two candidate systems for validation testing. While System A provided automatic voice messages for all warnings, System B provided voice messages for warnings and cautions which were enunciated only upon selection by the pilot. Validation testing yielded a single system concept which incorporates characteristics of both candidate systems, and which has been substantiated by empirical, analytical, and pilot preference data. Interest then developed in the concept of a flight status monitor which would help the crew to resolve safety problems, alerting them to operationally as well as mechanically abnormal conditions.

O C

**A84-18834****THE EFFECTS OF EXPOSURE TIME AND RETENTION TIME ON LOCATION MEMORY IN VISUAL INFORMATION PROCESSING**

L L SMITH (Central Florida, University, Orlando, FL) and D H LILES (Texas, University, Arlington, TX) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 812-815 refs

Two experiments were conducted using sixty subjects. The task was to remember where black dots were positioned on a polar grid pattern. Three experimental parameters were used: Stimulus Complexity, Exposure Time, and Retention Time. The results showed that the effects of both Exposure Time and Stimulus Complexity were significant and non-linear. The effect of Retention Time was not significant.

Author

**A84-18836#****REPEATED MEASURES OF INFORMATION PROCESSING**

M M HARBESON, M KRAUSE, A C BITTNER, JR (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA), and R S KENNEDY (Canyon Research Group, Inc., Orlando, FL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 818-822 Navy-supported research refs

The suitability of information processing tasks for inclusion in a battery of performance tasks is evaluated. The evaluations concern the statistical suitability of individual measures and their uniqueness and economy of use. The overall goal is to provide a basis for including tasks in the Performance Evaluation Tests for Environmental Research (PETER) battery. The tests are Baron's Graphemic and Phonemic Analysis and Posner's Letter Classification. The correlations of the basic measures tend to become stable with sufficient practice; derived measures, however, such as difference, slope, and ratio scores, do not attain stability. The Baron and Posner tasks have high reliabilities and are higher correlated with each other. A preliminary analysis suggests that both tests may be measuring the same thing. It is concluded that any of the Baron or Posner basic measures would be suitable for repeated measures testing.

C R

**A84-18838****SIMULATION AND TRAINING FOR AIRCRAFT CARRIER LANDINGS - AN ECONOMICAL MULTIFACTOR APPROACH**

D P WESTRA (Canyon Research Group, Inc., Orlando, FL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 830-834 refs

The effects of six factors on carrier-landing training are investigated using the Visual Technology Research Simulator (VTRS). The pilots chosen had no prior carrier-landing experience. The factors investigated are field-of-view, scene detail, platform motion, descent-rate cuing and training task (straight-in approaches vs circling approaches). After training under a certain factor-level combination, the subjects are tested on the day, wide-field-of-view, circling task with motion and without descent-rate cuing. It is found that the simulator and training factors generally produce small differences or no differences in transfer effectiveness. Some advantages are seen in the wide-field-of-view and high-detail conditions, but these effects are small and/or short-lived, generally disappearing after a few transfer trials. Training with straight-in approaches gives transfer performance that is equal to or better than that produced by training with circling approaches. No motion or descent-rate cuing effects on the transfer task are observed.

C R

**A84-18839#****APPLIED HUMAN FACTORS AND ITS IMPACT ON A HELICOPTER NIGHT VISION SYSTEM CONFIGURATION**

G P WALDROP, L B MCDONALD (McDonald and Associates, Inc., Orlando, FL), W A BREITMAIER (U.S. Navy, Naval Air Development Center, Warminster, PA), and T MITCHELL (U.S. Navy, Pacific Missile Test Center, Point Mugu, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 880-884

A description is given of the simulator, which is a CH-53 cockpit mounted on a six-degrees-of-freedom motion base. A terrain model board and a camera probe are used to provide real-time simulation of an infrared image for night flight. The simulated infrared imagery is projected on panel-mounted displays and superimposed with electronic flight symbology. The simulation comprises four phases. The first simulation investigates whether the sensor should be fixed or gimballed and whether or not a Doppler navigation system should be employed. The second tests the sensor and field-of-view requirements. The third phase examines hover symbology and tests helmet vs panel-mounted displays. It also includes wide and narrow fields of view. The fourth phase considers the usefulness of the control and display unit as a navigation aid.

C R

**A84-18841****DYNAMIC PERCEPTION OF COMPUTER GENERATED VISUAL INFORMATION IN AN ALTITUDE CONTROL TASK**

T MITCHELL (Singer Co., Link Flight Simulation Div., Sunnyvale, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 890-894

Investigations were conducted to determine what size (visual angle) of objects and where in the forward visual field objects should be placed to provide maximum effectiveness in a simple altitude control task. Two experiments placed between 7 and 9 degrees below the horizon enabled significantly better altitude control and induced the least tendency to drift in altitude. The two experiments investigated targets ranging from 2 to 20 degrees in horizontal visual angle. This variable did not prove to significantly affect altitude control or altitude drift. Subject variance was significant in both experiments.

Author

## A84-18842#

### VISUAL SIMULATION REQUIREMENTS FOR AIRCRAFT ASPECT RECOGNITION AT REAL WORLD DISTANCES

R S KENNEDY (Canyon Research Group, Inc., Orlando, FL), S C COLLYER (U.S. Navy, Naval Training Equipment Center, Orlando, FL), J G MAY (New Orleans, University, New Orleans, LA), and W P DUNLAP (Tulane University, New Orleans, LA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 901-905 refs

Computer-generated aircraft images displayed on a dome via a variable resolution target projector have been used to examine aspects of recognition sensitivity, or the distance at which subjects could determine the orientation of another aircraft. Four different target luminances, and three background luminances, were combined with four different levels of projector resolution in a partial parametric study in order to assess the relative effects of contrast, resolution, and brightness. Although all main effects were found to be significant, contrast accounted for the greatest variance and brightness the least. In the best condition studied, aspect recognition was conducted at more than 4 miles, while the most degraded conditions exhibited thresholds at 1.5 miles. These figures are comparable to those known to be required in outdoor training ranges and in combat. Individual differences in the four tested subjects' contrast sensitivity scores were predictive of their visual performance on the target aspect recognition task. O C

## A84-18843#

### PERIPHERAL CUES AND COLOR IN VISUAL SIMULATION

C L KRAFT, C D ANDERSON, and C L ELWORTH (Boeing Aerospace Co., Seattle, WA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 906-910 (Contract F47620-79-C-0030)

Flight performance as affected by visual field size, scene complexity and the use of color was measured in a Boeing 747 flight simulator. The visual simulator was a computer generated imagery system (G E Compuscene). Three experiments involving different flight regimes were conducted using military C-141 pilots as test subjects. Numerous parameters indicative of landing proficiency were recorded and analyzed to establish visual scene requirements. Author

## A84-18845#

### TRACKING BANDWIDTH MANIPULATIONS AND PROCESSING RESOURCE COST

W L DERRICK and T M MCCLOY (U.S. Air Force Academy, Colorado Springs, CO) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 932-935

The resource cost of tracking both low and high bandwidth signals is examined in a way that employs different tasks and a more powerful design than in the study by Wickens et al. It is hypothesized that the resource demand for the bandwidth manipulation is not localized in the early stages of processing (perceptual and central) but rather in the later stages (response execution). Employing the tenets of additive factors methodology, it is also hypothesized that a secondary task defined a priori as demanding response execution resources will interfere more with a primary tracking task when the signal bandwidth is high than when it is low. The hypothesis that bandwidth increases demand response execution resources is not supported. Experimental methods and control are discussed as possible reasons for the failure. C R

## A84-18846#

### PSEUDO-QUICKENING - A NEW DISPLAY TECHNIQUE FOR THE CONTROL OF HIGHER ORDER SYSTEMS

R GILL (Wright State University, Dayton, OH), C D WICKENS, E DONCHIN, and R E REID (Illinois, University, Champaign, IL) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 936-939 refs (Contract F49620-79-C-0233)

The concept of the pseudo-quicken display is introduced as a technique for aiding the control of higher order systems. In this display the intensity of the cursor is employed as a cue for optimal switching of manual control input. Performance on this display is compared with performance on an unaided, a quickened, and a phase plane display. Some advantages over the conventional display in performance are demonstrated by all three aided displays. When all aided groups transferred to an unaided conventional display, only those trained with the pseudo-quicken display showed benefits of prior training. This group also performed better than those who trained only with the conventional display. Author

## A84-18848

### THE MEASUREMENT OF THREE-DIMENSIONAL HAND MOTION BY THE USE OF V.T.R.

N MIYASHIRO (Hokkaido Institute of Technology, Sapporo, Japan) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 945-949 refs

The motion characteristics of reaching movements are investigated. Motion pictures are taken from the front and lateral planes and the three-dimensional coordinates of the marked points are read from the synthesized picture by a position analyzer. Calculations are made of the displacement, velocity, acceleration, joint angle and three-dimensional motion path. It is found that the mean overall motion path length for all the experimental conditions is approximately 115 percent of the linear distance. The ratio of the movement along the height axis to the short linear distance is found to be larger than that of the long linear distance. C R

## A84-18849#

### F-18 HUMAN ENGINEERING PROGRAM - A RETROSPECTIVE VIEW

L HITCHCOCK (FAA, Atlantic City, NJ), S C MERRIMAN (U.S. Navy, Naval Air Development Center, Warminster, PA), J P MOORE (McDonnell Douglas Corp., St. Louis, MO), and P FIELD (U.S. Marine Corps, El Toro, CA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 950-953

The human engineering program features considered critical to the F/A-18 were mission analysis, the institution and management of a contractor/Navy team approach, multiple design reviews, dynamic simulation of critical mission segments, and the development of ground support, testing, and training equipment. Attention is given to the simulator and mockup development, and to the contribution of U.S. Navy and Marine Corps pilots who participated in the program's 'Aircrew Systems Advisory Panel'. After delivery of 25 F/A-18 aircraft, which have accumulated over 10,000 flight hours, no significant human engineering deficiencies have been noted. O C

## A84-18850

### HUMAN OPERATOR SIMULATION IN THE COGNITIVE DOMAIN

F A GLENN, A L ZAKLAD, and R J WHERRY, JR. (Analytics, Inc., Willow Grove, PA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 964-968 refs

An interim report is presented regarding a long-term effort to design, implement, and apply a general-purpose tool for simulation of the human operator and the system which he operates. The

simulation tool involved is called the Human Operator Simulator (HOS). The concept of HOS was originally articulated by Wherry (1968). HOS was originally mainly developed for an assessment of system operability at early stages of the system design process. Attention is given to the structure of the HOS system, an example illustrating the operation of HOS, and modifications suggested in order to enhance HOS' cognitive capabilities. The representation of perceptual processes is considered along with the representation of knowledge about complex hardware systems, the representation of general knowledge, and the representation of attention. G R

**A84-18851\*#** Analytics, Inc., Willow Grove, Pa  
**VALIDATING CAR - A COMPARISON STUDY OF EXPERIMENTALLY-DERIVED AND COMPUTER-GENERATED REACH ENVELOPES**

R HARRIS, J BENNETT, and J STOKES (Analytics, Inc., Willow Grove, PA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 969-973  
 Navy-NASA-supported research refs

In the present investigation, Crewstation Assessment of Reach (CAR) results in the form of male hand reach envelopes were generated and compared with an anthropometric survey performed by Kennedy (1978) to determine the extent of the validity of the CAR model with respect to experimentally-derived anthropometric data. The CAR-generated reach envelopes extensively matched the Kennedy envelopes. The match was particularly good in the areas to the front and side from which the reach originated. Attention is given to the crewstation model, the operator sample population, the CAR analysis, aspects of validation methodology, and the modeling of experimental parameters. G R

**A84-18852**  
**EVAC COMPUTER SIMULATION OF PERSONNEL PERFORMANCE IN AIRPLANE EVACUATION**

D L PARKS and R A OSTRAND (Boeing Co., Seattle, WA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p. 974-978. refs

The emergency evacuation, or 'EVAC' computer model has been devised in order to reduce reliance on live evacuation tests with full passenger loads, which are at present required to demonstrate a new aircraft configuration's conformance to regulatory criteria. The model will demonstrate evacuation performance fidelity and credibility to the degree needed for acceptance as a valid evacuation test method, by developing a literal step-by-step simulation of the evacuation process. The resulting model performance elements are based on a time-line of evacuation performance events and of queuing behavior similarly to task-timeline analysis techniques. Performance time can be modified according to such individual criteria as age, sex, and aggressiveness, or related to features of the environment or systems, such as lighting, obstacles, and door size. O C

**A84-18853**  
**APPLICATION OF PROMETHEUS III, SIMULATION OF HUMAN CRASH DYNAMICS FOR ENERGY ABSORPTION STUDIES**

D W TWIGG and D L PARKS (Boeing Co., Seattle, WA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 979-983 refs

Prometheus III is a computer model of the dynamic interactions between the seat and the restraint and between the system and the occupant during a vehicle crash. The sled tests employing instrumented anthropomorphic dummies which were used to validate the model for engineering use are summarized. In addition, progress that has been made in calibrating the model to explore the influence of seat flexure on energy absorption is surveyed. Attention is given to some of the characteristics concluded to be important in achieving the calibration. Also discussed are general techniques for using the model to produce engineering tradeoff data, including the exploration of alternative seating concepts. The need to verify the model's prediction capability on the basis of

calibrations that use actual test data as a prerequisite to engineering acceptance and usage is emphasized. C R

**A84-18854\*#** National Aeronautics and Space Administration  
 Ames Research Center, Moffett Field, Calif.

**CONTINGENCY IN VISUAL SCANNING OF COCKPIT TRAFFIC DISPLAYS**

S R ELLIS (NASA, Ames Research Center, Moffett Field, CA) IN: Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 1005-1009 refs

A statistical method to identify reliable, repetitive scanning patterns in the positions of visual fixations has been developed and applied to data from 8 airline pilots who monitored cockpit displays of traffic information (CDTI). Their fixational transition patterns between points of interest on the display showed deterministic, statistical dependencies generally associated with symbols predicting future aircraft position. These dependencies constitute deviations from stratified random sampling of the visual information on the display, confirm the importance of future aircraft position information for the use of CDTI, and provide objective support for the existence of 'scanpaths' in visual fixation patterns. Author

**A84-18855\*#** National Aeronautics and Space Administration  
 Langley Research Center, Hampton, Va

**HOW A NEW INSTRUMENT AFFECTS PILOT'S MENTAL WORKLOAD**

R L HARRIS, SR (NASA, Langley Research Center, Hampton, VA), J R TOLE (Worcester Polytechnic Institute, Worcester, MA), A R EPHRATH (Bell Telephone Laboratories, Inc., Piscataway, NJ), and A T STEPHENS (Boeing Commercial Airplane Co., Seattle, WA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 1010-1013 refs

Display evaluation has generally been performed using reaction time experiments or subjective evaluations to determine which display is better suited for a particular application. A new testing procedure combined with two analysis techniques of scanning behavior have been used to evaluate two alternative display designs in a realistic setting. Tests were conducted in the Langley Research Center's General Aviation Simulator. The results indicated that a new bargraph type of vertical speed indicator located between the attitude indicator and the altimeter is looked at more quickly, appears to lower cognitive workload slightly, and was preferred over a conventional vertical speed indicator. Author

**A84-18856\*#** National Aeronautics and Space Administration  
 Langley Research Center, Hampton, Va

**THE EFFECTIVENESS OF USING REAL-TIME EYE SCANNING INFORMATION FOR PILOT TRAINING**

A A SPADY, JR (NASA, Langley Research Center, Hampton, VA), D H JONES, G D COATES, and R H KIRBY (Old Dominion University, Norfolk, VA) IN Human Factors Society, Annual Meeting, 26th, Seattle, WA, October 25-29, 1982, Proceedings Santa Monica, CA, Human Factors Society, 1982, p 1014-1017

A study to evaluate the idea of providing pilots feedback on their scan behavior as an instrumental training aid was conducted jointly by NASA, Piedmont Aviation, and Old Dominion University. The study used Langley's oculometer system to provide a real-time display of the trainee's scan to the instructor pilot in the aft part of the Boeing 737 training simulator at Piedmont. The trainees' scan behavior was also video-taped for viewing by the instructor and trainee after each training session. Based on qualitative data obtained during the study, scan behavior feedback was an effective tool for pilot training. Author



**A84-19276**

**HUMAN FACTORS SOCIETY, ANNUAL MEETING, 27TH, NORFOLK, VA, OCTOBER 10-14, 1983, PROCEEDINGS. VOLUMES 1 & 2**

A T POPE, ED and L D HAUGH, ED Meeting sponsored by the Human Factors Society and Institute of Electrical and Electronics Engineers Santa Monica, CA, Human Factors Society, 1983, Vol 1, 626 p., vol 2, 475 p

Topics discussed are related to aviation training, nuclear power plant human factors, display quality and visual performance, noise, human factors perspectives, nuclear power plant ergonomics, voice control and voice input techniques, human factors and aging, the vibroacoustic habitability of space stations, workload, training research and issues, and data entry Other subjects considered are concerned with human performance related to nuclear power plant safety, lifting, human factors modifications, pilot workload assessment, transportation safety, visual information processing, physiology and sports, robotics and the automated factory, training methodology, pilot performance and crew system assessment, behavioral decision making, and work structure and design Attention is also given to industrial occupational safety, training effectiveness, human problem solving in complex environments, ergonomic safety, computerized research methods, human factors in aviation safety, visual perception and pilot performance, and maintenance training G R

**A84-19278**

**TAILORING DAY SCENARIOS FOR NIGHT SIMULATION OF ADVANCED AIRCRAFT SYSTEMS**

J C SIMONS and S B HOTTMAN (Systems Research Laboratories, Inc., Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 9-12

This effort obtained mission planning factors and flight profiles for a simulator evaluation of a proposed night/adverse weather system Using two samples of pilots at two stages, generalized day profiles were reduced to a set of specific night profiles for evaluating proposed equipment The double interview method used in this study can be applied to similar situations which include diverse operational technique and strategies, but require a limited (but representative) number of flight profiles for a simulation evaluation of projected equipment (Acronyms are defined in the glossary at the end of the text) Author

**A84-19279**

**AN APPROACH FOR TRAINING AIRCRAFT NIGHT ATTITUDE RECOGNITION USING MICROCOMPUTER CAI**

S B HOTTMAN and K E URBAN (Systems Research Laboratories, Inc., Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 13, 14

Ten subjects participated in a one-group pretest-posttest experiment designed to define the feasibility of using microcomputer-based computer aided instruction (CAI) to train night aircraft attitude recognition Statistical analysis shows that significant improvement in scores occurred over the course of the study, but enhancements are still desirable in both the CAI methodology and presentation Author

**A84-19280#**

**EVALUATIONS OF DIGITAL IMAGERY PROCESSED BY ENHANCEMENT/RESTORATION TECHNIQUES**

B P CHAO (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 36-40 (Contract F49620-80-C-0057)

The extended capabilities of modern computers have led to new applications of digital image processing One application is concerned with an enhancement of image details to improve image interpretability The present investigation has the objective to

determine the efficacy of digital image enhancement/restoration processes as measured by human performance Two tasks relevant to military photointerpretation were considered An information extraction task required extraction of essential elements of information, while a subjective quality judgment task required rating an image in order to obtain its perceived interpretability It was found that image degradations, blur and noise, deterred the quality of digital imagery for interpretation However, the quality improved when the degraded images were processed with enhancement/restoration techniques G R

**A84-19281#**

**QUANTITATIVE MODELS OF IMAGE QUALITY**

R J BEATON (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 41-45 refs (Contract F49620-75-C-0055)

Image quality metrics are to provide display system designers or evaluators with an objective guideline for assessing the performance of various system configurations in terms which, ideally, relate to human performance The present investigation is concerned with the feasibility of several possible forms of image-dependent quality metrics The characteristics of image quality metrics are considered, taking into account the Perceptual Equivalent Passband (PEP) metric, the Equivalent Width (EW) metric, the Squared Spatial Frequency (SSF) metric, the Modulation Transfer Function Area (MTFA), the Gray Shade Frequency Product (GSFP) metric, and the Integrated Contrast Sensitivity (ISC) metric Attention is given to the digital image database, the human performance database, and noise and blur degradation G R

**A84-19282**

**FLIGHT STATIONS AND OFFICES OF THE FUTURE - HOW SIMILAR WILL THEY BE**

R L WASSON (Sperry Corp., Blue Bell, PA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 85-88

Information creation and management are starting to become the major task elements for both the office worker and the pilot The computer technology which is enabling this will not only improve performance but will lead to greater user satisfaction Research has been ongoing in both of these work environments Human factors personnel engaged in either area can benefit from an increased sharing of their respective achievements Author

**A84-19283#**

**A COMPARISON OF MANUAL AND VOCAL RESPONSE MODES FOR THE CONTROL OF AIRCRAFT SYSTEMS**

A J ARETZ (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 97-101 refs

It is pointed out that rapid advancements in the ability of computers to recognize speech have provided the technology for the application of voice control in the operation of complex systems The Air Force is considering, for instance, the use of voice control in future fighter aircraft Thus, in situations in which pilots are reluctant to take their hands off the stick and throttle, voice control could be used to change the radio frequency The present investigation has the objective to compare a vocal response with a manual response in single task conditions, taking into account conditions in a fighter cockpit simulator Sixteen operationally qualified male Air Force pilots served as subjects in the experiments In a low level terrain following phase when flight control of the aircraft is critical, the vocal response mode is found to be probably the most effective alternative since it has the least impact on flight performance Author

**A84-19285#****ASSESSING THE VALIDITY OF SWAT AS A WORKLOAD MEASUREMENT INSTRUMENT**

S P BOYD (U.S. Air Force Academy, Colorado Springs, CO) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 124-128. Research supported by the Virginia Polytechnic Institute and State University refs

Investigations have been conducted to search for a subjective metric of mental workload (w/1) which yields an interval scale. In the approach employed by the Subjective Workload Assessment Technique (SWAT), conjoint analysis is used to derive an interval w/1 scale based on three component dimensions, taking into account time load, mental effort load, and psychological stress load. SWAT methodology is based on the implicit assumption that people can accurately predict the amount of x/1 they would experience under various levels of the three dimensions. The present study has the objective to determine if the dimensions are subjectively orthogonal. Taking into account certain limitations, the obtained results do indicate that the subjective experience of the three SWAT dimensions lack subjective orthogonality. G R

**A84-19289****TIME-COMPRESSED COMPONENTS FOR AIR-INTERCEPT CONTROL SKILLS**

M VIDULICH, Y-Y YEH, and W SCHNEIDER (Illinois, University, Champaign, IL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 161-164.

The study tested guidelines for the use of microprocessors in training spatial skills for air traffic control. The central issue was the use of time-compressed simulation to aid the development of skill in identifying turn points and rollout headings for aircraft. Two groups of subjects were used. One group trained with a real-time simulation of the task, while the second group trained with a time-compressed version of the task running about 20 times as fast as real-time trials. Both groups were then tested in real-time trials. The results indicate that time compression can be a useful technique for increasing the efficiency of training. Author

**A84-19291#****PILOT WORKLOAD FACTORS IN THE TOTAL PILOT-VEHICLE-TASK SYSTEM**

R K HEFFLEY (Manudyn Systems, Inc., Los Altos, CA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 234-238 refs (Contract N62269-82-R-0712)

This paper is based on a current study of pilot workload models for crucial Navy flight tasks such as the carrier landing and high-speed, low-level navigation. The objective is to construct a more rigorous and complete view of the overall pilot-vehicle-task system in order to describe how facets of pilot workload can be associated with elements of the system. The purpose of the paper is to discuss workload features in a system context as a first step to developing a more thorough workload prediction process for the design and operation of aircraft. Author

**A84-19292\*# Systems Research Labs, Inc., Dayton, Ohio  
QUANTIFICATION OF CREW WORKLOAD IMPOSED BY COMMUNICATIONS-RELATED TASKS IN COMMERCIAL TRANSPORT AIRCRAFT**

W H ACTON, M S CRABTREE, J C SIMONS (Systems Research Laboratories, Inc., Dayton, OH), F E GOMER, and J S ECKEL (General Physics Corp., Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 239-243 refs (Contract NAS2-11562)

Information theoretic analysis and subjective paired-comparison and task ranking techniques were employed in order to scale the workload of 20 communications-related tasks frequently performed by the captain and first officer of transport category aircraft. Tasks

were drawn from taped conversations between aircraft and air traffic controllers (ATC). Twenty crewmembers performed subjective message comparisons and task rankings on the basis of workload. Information theoretic results indicated a broad range of task difficulty levels, and substantial differences between captain and first officer workload levels. Preliminary subjective data tended to corroborate these results. A hybrid scale reflecting the results of both the analytical and the subjective techniques is currently being developed. The findings will be used to select representative sets of communications for use in high fidelity simulation. Author

**A84-19297#****A METHODOLOGICAL INVESTIGATION OF THREE PSYCHOPHYSICAL TECHNIQUES FOR RAPID MEASUREMENT OF CONTRAST SENSITIVITY**

A P GINSBURG (USAF, Aviation Vision Laboratory, Wright-Patterson AFB, OH), A C BITTNER, JR, M M HARBESON (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA), and R S KENNEDY (Canyon Research Group, Inc., Orlando, FL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 264-268 refs

Stability and sensitivity are evaluated for three methods of obtaining contrast sensitivity functions. The contrast sensitivity function is a general method for assessing visual capacity. The three methods for obtaining the functions are the Method of Adjustment, Beke's Tracking, and the Method of Increasing Contrast. For each method, a microcomputer-controlled video display was used to generate five different stationary gratings: 1, 2, 4, 8, and 16 cycles per degree. Individual contrast sensitivity functions were determined for each of 13 observers over five days. Analyses were conducted on reliabilities, means, and variances across frequencies, methods, and days. The Method of Increasing Contrast demonstrated near-largest or largest reliabilities over all frequencies across days. In addition, it appeared differentially stable from the onset of measurement (significance level greater than 10) while both the Method of Adjustment and Beke's demonstrated differential instability (level less than .002). Based on the present findings, the Method of Increasing Contrast may be recommended as the method of choice. D H

**A84-19299\*# Perceptronics, Inc., Woodland Hills, Calif  
MODEL-BASED ESTIMATION AND PREDICTION OF TASK-IMPOSED MENTAL WORKLOAD**

A M. MADNI (Perceptronics, Inc., Woodland Hills, CA) and J LYMAN (California, University, Los Angeles, CA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 314-318 refs (Contract NAG2-216)

Mental workload has been an area of intensive research for better than a decade. One specific area of interest in aircrew related workload research is concerned with the development of quantitative indices of workload in aircraft piloting tasks. This paper presents a model-based approach for quantifying mental workload in operational terms. The suggested modeling framework is based on an interpreted Petri net characterization of a task in which 'places' are equated to specific task-related activities and 'transitions' are viewed as internal or external forcing events. It is shown that within this framework quantitative assessments can be made of both cumulative and instantaneous workload associated with the performance of a task and its individual component subtasks. It is suggested that insights gained from analyzing task-specific workload within this modeling paradigm can suggest plausible explanations for reconciling discrepancies between subjectively elicited workload estimates and behavioral/performance measures. Author



**A84-19300\*#** Purdue Univ, Lafayette, Ind  
**MEASURING PILOT WORKLOAD IN A MOVING-BASE  
 SIMULATOR. I ASYNCHRONOUS SECONDARY  
 CHOICE-REACTION TASK**

B H KANTOWITZ (BITS, Inc, Purdue University, West Lafayette, IN), S G HART (NASA, Ames Research Center, Moffett Field, CA), and M R BORTOLUSSI (BITS, Inc, West Lafayette, IN) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 319-322 refs  
 (Contract NCC2-228)

The de facto method for measuring airplane pilot workload is based upon subjective ratings. While researchers agree that such subjective data should be bolstered by using objective behavioral measures, results to date have been mixed. No clear objective technique has surfaced as the metric of choice. It is believed that this difficulty is in part due to neglect of theoretical work in psychology that predicts some of the difficulties that are inherent in a futile search for 'the one and only' best secondary task to measure workload. An initial study that used both subjective ratings and an asynchronous choice-reaction secondary task was conducted to determine if such a secondary task could indeed meet the methodological constraints imposed by current theories of attention. Two variants of a flight scenario were combined with two levels of the secondary task. Appropriate single-task control conditions were also included. Results give grounds for cautious optimism but indicate that future research should use synchronous secondary tasks where possible. Author

**A84-19301#**  
**PILOT PERFORMANCE MEASUREMENT METHODOLOGY FOR  
 DETERMINING THE EFFECTS OF ALCOHOL AND OTHER  
 TOXIC SUBSTANCES**

H L TAYLOR, J A DELLINGER, R F SCHILLING, and B C RICHARDSON (Illinois, University, Urbana, IL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 334-338 refs  
 (Contract F33615-83-K-0612)

Equipment and methodology for determining the effects of toxic substances on pilot performance were evaluated using ethyl alcohol as a reference substance, since its effects on flying performance in a flight simulator are well known. Four levels of ethyl alcohol were administered to eight instrument trained pilots in a Latin Square within subjects design. Significant performance decrements were found on instrument holding pattern, Instrument Landing System (ILS) approach, and Sternberg's choice reaction time tasks. Author

**A84-19302#**  
**SPEED-ACCURACY TRADEOFFS IN SPATIAL ORIENTATION  
 INFORMATION PROCESSING**

R E SCHLEGEL (Oklahoma, University, Norman, OK) and W F STORM (USAF, School of Aerospace Medicine, Brooks AFB, TX) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 359-363 refs  
 (Contract F49620-82-C-0035)

A study was conducted to further evaluate the Manikin Task, a test of spatial orientation information processing. The objectives of the study were to determine the speed vs accuracy tradeoff characteristics of the task and to assess performance on the task under the influence of ethyl alcohol. Response times and accuracy were measured on five subjects over a five-week period. Analysis of the data indicated a definite decline in accuracy corresponding to a forced decrease in response time. The effect of alcohol was evidenced by a change in the slope of the speed-accuracy tradeoff function. Author

**A84-19304#**  
**PILOT ORIENTED PERFORMANCE MEASUREMENT**

J DE MAIO, H H BELL, and J BRUNDERMAN (USAF, Human Resources Laboratory, Williams AFB, AZ) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 463-467 refs

A pilot-oriented automated performance measurement system (APMS) is described. APMSs reduce the volume of data from flight simulators to an amount which is manageable and understandable. The pilot-oriented APMS, unlike the aircraft-state-oriented APMS, defines measurement intervals based on control inputs. Control inputs are identified by discrete changes in flight path. These intervals are psychologically relevant in that they begin with a goal-directed control input and end with a countervailing input. By relating performance in the pilot-defined intervals to state-defined intervals, it is possible to quantify performance on given flight segments (e.g., a level turn), and to specify factors which lead to a given level of performance. D H

**A84-19305#**  
**CREW SYSTEM ASSESSMENT METHODS APPLIED TO  
 DERIVATIVE FIGHTER COCKPITS**

G G KUPERMAN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), R W MOSS, and R A BONDURANT, III (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 473-477 refs

Representatives from five Air Force Laboratories were tasked to perform an assessment of conceptual cockpit designs being considered for a derivative, dual role fighter weapon system. An in-cockpit 'role playing' exercise, demonstrating the tasks of a composite weapon system mission scenario, was employed in obtaining expert subject opinion data. Author

**A84-19306#**  
**MAGIC - RIDING THE CREST OF TECHNOLOGY**

G D LIZZA (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH), B HOWARD, and C ISLAM (BDM Corp, Dayton, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 526-530

With the advent of integrated electronics displays in advanced cockpit design, the role of dynamic mockups is becoming increasingly important. The human factors researcher can now evaluate dynamic computer generated formats and real-time interactive control methods in preliminary crew station design phases. This ability to prescreen candidate display formats prior to evaluation in high fidelity simulators is very cost effective. Instead of being limited to conventional static capability, the rapid advances in micro-chip technology now allow more sophisticated research at the mockup level. This paper describes the design of a dynamic mockup which incorporates state-of-the-art microprocessors, graphic systems, and voice capability. Author

**A84-19308#**  
**TIMELY APPLICATION OF ADVANCED HUMAN FACTORS TEST  
 AND EVALUATION TECHNIQUES DURING THE ACQUISITION  
 OF NEW AIR FORCE SYSTEMS**

M L FRAZIER (USAF, Operational Test and Evaluation Center, Kirtland AFB, NM) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1 Santa Monica, CA, Human Factors Society, 1983, p 581-583

A model is proposed for the transfer of human factors technologies for test and evaluation of modern Air Force systems. A two-pronged effort is recommended to ensure the availability of appropriate technology for new Air Force acquisitions: revise Air Force policies indicated in Air Force Regulation 800-15 and ensure timely state-of-the-art human factors technology flow which parallels the major system acquisition process. An essential element in the model is to establish liaison activities between the system test

and evaluators and the advanced developers and researchers  
D H

**A84-19309#**  
**USE OF LOW COST, LOW FIDELITY MOCKUPS FOR PREPRODUCTION TESTING**

C A BOHN (US Navy, Naval Air Test Center, Patuxent River, MD) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 589-591

Two examples are given of the use of early laboratory-based testing of control/display systems. Reliance on flight testing has proven inadequate because the information-operator interface is too complex. A quick fix is the use of low-fidelity mockups for rapid testing and methods development. This can be both cost-effective and responsive to the dynamics of the control/display development cycle. The first example presents the design of formats for a universal control/display layout to be used as a replacement for conventional pushbutton technology. The second presents testing designed to determine the amount and type of control/display required for a crewstation functional upgrade. Both examples are from the test and evaluation work being performed on a Navy patrol aircraft. A laboratory is described which is being developed to permit this approach to testing.  
D H

**A84-19310#**  
**DEVELOPMENT OF A NAVAL AVIATION ANTHROPOMETRY COCKPIT COMPATIBILITY PROGRAM**

W F MORONEY and R E HUGHES (US Navy, Naval Air Test Center, Patuxent River, MD) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 592-596 refs

The present cockpit assignability program assumes that (1) the individual's anthropometric data are correct and (2) that the visual and reach requirements for each cockpit have been correctly defined. Unfortunately, this is not necessarily the case. The three-pronged effort to resolve this problem includes (1) improving the quantity and quality of individual anthropometric data, (2) standardizing cockpit measurement techniques, and (3) combining the data from both of the above into a decision making model. The end result of these actions should be more appropriate assignments to aircraft cockpits and better data for use in analysis of accidents and ejections.  
Author

**A84-19311#**  
**THEORETICAL DEVELOPMENT OF AN ADAPTIVE SECONDARY TASK TO MEASURE PILOT WORKLOAD FOR FLIGHT EVALUATIONS**

S G SCHIFFLETT (US Navy, Naval Air Test Center, Patuxent River, MD) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1983, p 602-605 refs

A series of research projects were reviewed that formulated the basis for the theoretical development and evaluation of an adaptive secondary task to measure pilot workload. The final flight project established the technical feasibility of using a visual and auditory item-recognition (Sternberg) task as a measure of sensory-response loading and reserve information processing capacity while flying precision pitch maneuvers simulating terrain profiles. The discrete item secondary task presented letters of the alphabet at a rate driven by a scoring algorithm that adapted to the pitch error scores i.e., cross-coupled to the primary task. The preliminary results indicate an appreciable increase in reaction time and errors for the visual secondary task while flying the terrain avoidance primary task as compared to flying the same task under auditory task loading. Preliminary conclusions support the multiple resource model of information processing.  
Author

**A84-19312**  
**CONDUCTING SIMULATOR TRAINING EFFECTIVENESS STUDIES - LESSONS LEARNED IN THE F-16 SAMT EVALUATION**

J. A. FITZPATRICK, R J HRTZ, and J SMITH (Applied Science Associates, Inc., Valencia, PA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2. Santa Monica, CA, Human Factors Society, 1983, p 627-631

A recent evaluation of simulator training effectiveness encountered many difficulties associated with the military field environment. These problems arose despite careful planning. The experiences of this study provide useful lessons on various topics, including the following: obtaining equipment for evaluation purposes, scheduling the study, interacting with military organizations, and general planning strategies.  
Author

**A84-19313**  
**TRACKING WITH MULTIPLE INDEPENDENT RESPONSE FUNCTIONS**

J BERKHOUT and M STEDMAN (South Dakota, University, Vermillion, SD) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2. Santa Monica, CA, Human Factors Society, 1983, p. 668-670 refs

Some situations where superior tracking performance can be obtained using multiple independent response functions are discussed. Such situations may be characterized by brief duration and a very high accuracy requirement, together with a high cost penalty for errors of small magnitude, such as the delivery of 'smart' ordnance. Tests of bimanual tracking have shown that an optimum bimanual configuration would involve segregation of frequencies, with low-frequency activity tracked by the nondominant hand and with the dominant hand reserved for fine adjustments in the high frequency domain. Social tracking, in which a subject's response function becomes the forcing function for a second subject, and multivector tracking, which involves response function averaging, are discussed in terms of their interesting possibilities for training in motor skills acquisition.  
C D.

**A84-19314\*#** Georgia Inst of Tech, Atlanta  
**THE EFFECTS OF LEVEL OF KNOWLEDGE UPON HUMAN PROBLEM SOLVING IN A PROCESS CONTROL TASK**

N M. MORRIS and W B ROUSE (Georgia Institute of Technology, Atlanta, GA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2. Santa Monica, CA, Human Factors Society, 1983, p 690-694 refs (Contract NAG2-123)

The effect of knowledge of a system on the performance of the operator has been investigated using PLANT, a generic simulation of a process. Four sets of written instructions representing the what, how, and why of system control were utilized by groups of subjects who controlled PLANT in a variety of familiar and unfamiliar situations. Written test results at the end of the experiments showed that the instructions had no effect on the primary goal of production, but those groups receiving guidelines for operation (the how) controlled the system in a more stable manner. Principles (the why) had no apparent effect on the subjects' performance. There was no difference between groups in diagnosing unfamiliar events.  
C D

**A84-19315\*#** National Aeronautics and Space Administration  
Ames Research Center, Moffett Field, Calif  
**CONFLICT RESOLUTION MANEUVERS DURING NEAR MISS ENCOUNTERS WITH COCKPIT TRAFFIC DISPLAYS**

E PALMER (NASA, Ames Research Center, Moffett Field, CA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2. Santa Monica, CA, Human Factors Society, 1983, p 757-761

The benefits and liabilities associated with pilots' use of a cockpit traffic display to assess the threat posed by air traffic and to make small maneuvers to avoid situations which would result in collision avoidance advisories are experimentally studied. The

crew's task was to fly a simulated wide-body aircraft along a straight course at constant altitude while intruder aircraft appeared on a variety of converging trajectories. The main experimental variables were the amount and quality of the information displayed on the intruder aircraft's estimated future position. Pilots were to maintain a horizontal separation of at least 1.5 nautical miles or a vertical separation of 500 ft, so that collision avoidance advisories would not be triggered. The results show that pilots could usually maneuver to provide the specified separation but often made course deviations greater than 1.5 nm or 500 ft. C D

**A84-19316\*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif**  
**INFLUENCE OF A PERSPECTIVE COCKPIT TRAFFIC DISPLAY FORMAT ON PILOT AVOIDANCE MANEUVERS**

S R ELLIS (NASA, Ames Research Center, Moffett Field, California, University, Berkeley, CA) and M W MCGREEVY (California, University, Berkeley, CA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 762-766 refs

The perspective projections of cockpit displays of traffic information on CRTs as a means of presenting vertical separation information to airline pilots were experimentally studied. Identical sets of traffic encounters were viewed by pilots either using a plan-view or perspective traffic display which presented identical separation information. The pilots maneuvered somewhat earlier with perspective displays and maneuvered more frequently in the vertical dimension. Another feature of the maneuver pattern was the absence of a tendency to turn toward an intruding aircraft. The previously observed bias toward horizontal maneuver is probably not based on the procedural reasons often given, but probably reflects the poorer presentation of vertical separation on previously used traffic displays. C D

**A84-19317\*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif**  
**PRIMARY SEPARATION BETWEEN THREE AIRCRAFT USING TRAFFIC DISPLAYS**

S L CHAPPELL (Informatics General Corp., Moffett Field, CA) and E A PALMER (NASA, Ames Research Center, Man/Vehicle Systems Div., Moffett Field, CA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 767-771 refs

The use of a sophisticated traffic and map display termed electronic flight rules (EFR) by general aviation pilots for primary separation in low density airspace is studied. The experimental flights were made under four conditions with and without sensor noise in the traffic information and with and without communications for traffic coordination. Pilots were required to maintain two miles horizontal and 500 ft vertical separation from other aircraft for 24 different traffic situations repeated randomly for each of the four experimental conditions. Of 1152 aircraft encounters 12.8 percent were in violation of separation minimums. In general, the effects of sensor noise were minimal, communications affected some of the measures, and the group effect was quite significant. When pilots were able to communicate and coordinate their maneuvers, the time to resolve conflict was reduced. C D

**A84-19318\*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va**  
**SELF-SEPARATION IN TERMINAL AREAS USING CDTI**

D H WILLIAMS (NASA, Langley Research Center, Hampton, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 772-776 refs

The Langley Research Center is participating in a joint NASA/FAA program designed to explore the potential benefits and liabilities of Cockpit Display of Traffic Information (CDTI) for a broad range of applications. As a part of this effort, part-task piloted simulations have been conducted to determine the effect of various display parameters and separation criteria on terminal

area in-trail following using CDTI. Current experiments are evaluating cockpit procedures and crew workload aspects of self-separation tasks in a simulated full-system terminal area environment. This paper will summarize the results of the part-task terminal area experiments and discuss the current full-system simulation experiments involving active self-separation tasks.

Author

**A84-19319\*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va**  
**SIMULATION OF A COCKPIT DISPLAY CONCEPT FOR INCREASED AIRPORT CAPACITY**

T S ABBOTT (NASA, Langley Research Center, Hampton, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 777-781 refs

A research effort has been undertaken to determine the feasibility of employing a forward-looking cockpit display to provide information that would enable aircraft to utilize reduced separation, and hence increased runway capacity, through the application of multiple-glide-path approach techniques. The current study was an initial exploration into this concept in which traffic information was added to a HUD format to allow the pilot to monitor the traffic situation and to self space on a lead aircraft during a simulated single glide-path approach. The results of this study indicate that this display concept can provide sufficient information to the pilot for traffic monitoring and self separation. Additionally, the pilots noted that an increase in situational awareness, relative to conventional instrument flight, was provided by the traffic information on the display. Author

**A84-19321#**  
**DESIGN FOR EFFECTIVE MAINTENANCE - SAFETY DATA PROVIDE IMPORTANT DIRECTIONS**

J C SCHMITT (Harris Corp., Melbourne, FL) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 843-847 (Contract N62269-81-R-0771)

Portions of the Naval Safety Center Accident and Mishap Data Base have been examined in order to formulate guidelines as to how safety data can be used to generate principles of human factors design for the maintainer. Sixty-six objective variables as well as narrative data from 5886 mishap cases were analyzed. A nonparametric case selection model was developed, resulting in close examination of three specific clusters of similar cases. Design improvements were clearly indicated for each, the methodology used to select them is extensible to other real-world data bases. C D

**A84-19323\*# Georgia Inst of Tech, Atlanta**  
**A COMPUTERIZED, PROCEDURAL AID FOR FLIGHT CREWS**

J M HAMMER (Georgia Institute of Technology, Atlanta, GA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 870-873 refs (Contract NAG2-123)

A computer program for detecting pilot error is described. The program observes pilot actions through the aircraft controls and state, and the actions are compared to those of a procedural script which can be considered a prescriptive model of the procedural aspects of flight. Pilot error is a discrepancy between the pilot actions and the script. The script has a hierarchical structure consisting of a single script at the highest level, scripts for the major phases of flight at the next level, scripts for procedures to be executed during these phases, and procedure step scripts at the bottom. The program interprets the aircraft data base in terms of the script, detecting errors of commission from a set of allowed and disallowed changes stored with each script element. C D

**A84-19325****KEYBOARD DESIGN VARIABLES EVALUATED DURING DUAL-TASK MODE SELECTION**

M D HANSEN (Ford Aerospace and Communications Corp., Houston, TX) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 924-927 refs

In the design of an aircraft cockpit, two problems of experimental interest are related to display location and panel design. The present study is concerned with considerations regarding the characteristics of a keyboard interfaced with a remote display. Twenty-four pilots participated as subjects in this study. Attention is given to mean response time as a function of keyboard size. On the basis of the obtained results, it is recommended that a keyboard with large keys considered in the study should be used in selecting modes with USAF approved flight gloves from a remote display. G R

**A84-19327#****COLOR CONTRAST METRICS FOR HEAD-UP DISPLAYS**

D L POST (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), T M LIPPERT, and H L SNYDER (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 933-937 refs (Contract N00014-78-C-0238)

The present investigation has the objective to further the understanding of relationship between color differences and human performance, taking into account a comparison of the practical merits of several color spaces. Two groups of college-age subjects were used in the experiments. The first experiment simulated the viewing of a head-up display (HUD) by presenting colored stimuli consisting of a simplified vertical situation display superimposed on a static computer-generated background. The second experiment used as background 10 color photographs which had been digitized. This approach was used to simulate normal HUD viewing conditions more realistically than in the first experiment. G R

**A84-19328****A COMPARISON OF ANALOG AND DIGITAL SCALES FOR USE IN HEADS-UP DISPLAYS**

M L MOROZE and J M KOONCE (Massachusetts, University, Amherst, MA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 938-940 refs

In the experiment described, subjects are taught to fly five flight maneuvers using three different types of displays, namely a traditional round-dialed instrument panel, a linear tape-type of heads-up display (HUD), and an HUD that employs digital symbols for the flight parameters. Once a predetermined level of proficiency is achieved on each of the displays, the subjects are required to execute each of the maneuvers on each of the displays while performing a secondary task. This secondary task consists in reporting the presence of odd-even-odd sequences of digits from a continuous string of digits presented by a tape recorder. It is found that more trials are required to learn the abstract display than the traditional display. When placed under the loading stress of monitoring the aural signals for odd-even-odd sequences while flying, the abstract display becomes significantly more difficult to fly than the traditional display. It is pointed out that in designing displays for operators, care must be taken to ensure not only adequate performance under normal conditions but also under adverse stressful conditions. C R

**A84-19330****EVALUATION OF SPEECH TECHNOLOGY FOR AUTOMATIC TARGET RECOGNITION**

S J MOUNTFORD, J SCHWARTZ, and K GRAFFUNDER (Honeywell Systems and Research Center, Minneapolis, MN) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 965-969, Abridged

A speech-interactive system is integrated with a prototype automatic target recognizer. The situation simulated is that of an attack helicopter pop-up maneuver searching for several target types. The tasks during operational control of the target screener involve pilot entry of navigation coordinates, targeting mode, target type, target selection and weapon preparation. The sequence of tasks is evaluated experimentally with the aid of three different modalities of interaction, namely speech recognition and speech generation dialogue, speech recognition with visual prompting, and conventional visual-manual transactions. The results suggest significantly better flight control performance during simultaneous speech-interaction for the targeting tasks. The speech technology results indicate that there are selective performance benefits for the entire sequence of targeting tasks which are not apparent at the individual switch-closure level. C R

**A84-19331#****IS A PICTURE WORTH 1000 WORDS - WRITTEN OR SPOKEN?**

J S HAWKINS, J M REISING, G D LIZZA, and K A BEACHY (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 970-972 refs

The effectiveness of pictorial format representation of emergency procedures to aircrew members as compared to text or voice has not been demonstrated before. This study compares these variables in simulated combat missions. Although the flying performance measures revealed no statistically significant differences between the presentation modes, strong subjective differences were found. Author

**A84-19332****DEVELOPMENT OF A HUMAN FACTORS METHODOLOGY FOR NASA-GODDARD SPACE FLIGHT CENTER**

P M VAN BALEN and C M MITCHELL (George Mason University, Fairfax, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 980-984 refs

NASA Goddard Space Flight Center, realizing the importance of the human-computer interface, has begun the process of integrating human factors considerations into system design. A methodology was needed to direct the process of incorporating human factors recommendations into the design process and to introduce human factors principles and procedures to Goddard projects. To gather necessary background information for an effective methodology, a diary was kept, recording the process of a Goddard human factors analysis. The diary technique was effective in identifying issues and steps relevant to the methodology. This paper describes and evaluates the diary as an information-gathering tool. Finally, the methodology is summarized and its effectiveness evaluated. Author

**A84-19333****CASE STUDY - DESIGNING THE ERBS CONTROL ROOM**

L J STEWART, C M MITCHELL, and E D MURPHY (George Mason University, Fairfax, VA) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 985-989 refs

NASA Goddard Space Flight Center is the site of command, control, and communication support for NASA near-earth satellites. Recently, human factors has been incorporated into the control room design process. The first project was the Earth Radiation Budget Satellite (ERBS). This paper summarizes the results of

the ERBS human factors analysis, discusses the problems of human factors involvement in the Goddard design process, and identifies and discusses issues likely to determine the effectiveness of future Goddard human factors analyses Author

**A84-19334#**

### **OPTICAL FLOW AND TEXTURE VARIABLES USEFUL FOR DETECTING CHANGES IN SIMULATED SELF MOTION**

D H OWEN, L J HETTINGER, L WOLPERT, S B TOBIAS, and R WARREN (Ohio State University, Columbus, OH) IN Human Factors Society, Annual Meeting, 27th, Norfolk, VA, October 10-14, 1983, Proceedings Volume 2 Santa Monica, CA, Human Factors Society, 1983, p 996-1000 refs (Contract AF-AFOSR-81-0078, F33615-83-K-0038)

Several methods are presented for breaking linkages among global optical flow and texture variables in order to assess their usefulness in experiments requiring observers to distinguish change in speed or heading of simulated self motion from events representing constant speed or level flight Results of a series of studies testing for sensitivity to flow acceleration or deceleration, flow-pattern expansion variables, and the distribution of optical texture density are presented Theoretical implications for determining the metrics of visual self-motion information, and practical relevance for pilot and flight simulator evaluation and for low-level, high-speed flight are discussed Author

**N84-14684#** Joint Economic Committee (U S Congress)

### **THE IMPACT OF ROBOTICS ON EMPLOYMENT**

Washington GPO 1983 34 p Hearings before the Subcomm on Econ Goals and Intergovt Policy of the Joint Econ Comm, 98th Congr, 1st Sess, 18 Mar 1983 (GPO-21-160) Avail Subcommittee on Economic Goals and Intergovernmental Policy

The prospective impact of robotics on employment in the U S are evaluated Robotics refers to the use of sophisticated programmable or computer-controlled robots to perform routine and repetitions tasks Supplying the number of trained assemblers, technicians, maintenance personnel, programmers, and operators is addressed Effects on employment are also addressed NW

**N84-14685#** Illinois Univ, Urbana Engineering Psychology Research Lab

### **THE EFFECTS OF TASK STRUCTURES, DYNAMICS OF DIFFICULTY CHANGES, AND STRATEGIC RESOURCE ALLOCATION TRAINING ON TIME-SHARING PERFORMANCE**

P TSANG and C D WICKENS Oct 1983 53 p (Contract N00014-79-C-0658, NR PROJ 196-158) (AD-A134112, EPL-83-3/ONR-83-3) Avail NTIS HCA04/MFA01 CSCL 05E

A distinction was made between two aspects of time-sharing performance time-sharing efficiency and attention allocation optimality The first one is concerned with the level of joint performance of the time-shared tasks The second one is concerned with the consistency of protecting the high priority task from variations in the task demand Time-sharing performance was then evaluated as a function of the task structures of the component time-shared tasks and the strategic training of resource allocation Time-sharing efficiency was observed to decrease with an increasing overlap of resources that the time-shared tasks utilized Results also tend to support the hypothesis that resource allocation is more optimal when the time-shared tasks placed heavy demand on common processing resources than when they utilize separate resources The verbal strategy instructions employed to induce more optimal allocation were more successful for the task pairs utilizing common resources than for those utilizing separate resources GRA

**N84-14686#** Illinois Univ, Urbana Engineering-Psychology Research Lab

### **PROCESSING PHENOMENA AND THE DISSOCIATION BETWEEN SUBJECTIVE AND OBJECTIVE WORKLOAD MEASURES**

M D VIDULICH and C D WICKENS Oct 1983 46 p (Contract N00014-79-C-0658) (AD-A134050, UIIU-EPL-83-2/ONR-83-2) Avail NTIS HCA03/MFA01 CSCL 05E

Causes of dissociation between subjective workload assessments and objective performance were investigated A Sternberg memory search task was utilized Sternberg task configurations varied in the automaticity of performance, stimulus presentation rate, discernability of stimuli, and the value of good performance Automaticity in Sternberg task performance was manipulated by using two independent sets of stimuli, one of which was consistently mapped (i.e., targets were always the same) while the other was inconsistently mapped (i.e., targets changed over trials) Also, all Sternberg configurations were performed both as single tasks and as part of dual task combinations (with a manual control task) During testing subjects rated all trials on eight typical bipolar rating scales The results were interpreted as supporting cognitive-processing-based experimentation in subjective workload assessment aimed at identifying differences between the cognitive processing accounting for subjective assessments and those processes that produce performance GRA

**N84-14687#** Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate

### **A SERVO CONTROLLED RAPID RESPONSE ANTI-G VALVE**

R J CROSBIE 17 Oct 1983 19 p (Contract W0584) (AD-A134042, NADC-83087-60) Avail NTIS HCA02/MFA01 CSCL 09E

Current anti-G suits inflate under control of an anti-G valve and apply pressure to the abdominal and leg areas to prevent blood pooling in the lower portions of the body The anti-G valves employ a spring and mass construction which regulates air flow to the suit in direct proportion to the amount by which the applied G force exceeds a nominal 2G breakout force This mechanical method, however, does not permit rapid filling of the suit required during high onset G profiles generated by high performance VA/VF aircraft This Center has designed, constructed, and tested a prototype servo controlled rapid response anti-G valve system This system, which employs a pressure transducer located in the valve outlet line but modified to represent the pressure in the anti-G suit as the feedback signal, is capable of pressurizing the suit on a schedule which closely coincides with that of a rapidly applied G profile In addition, this new valve is capable of improved system reliability A series of manned tests were conducted on the NAVAIRDEVCON human centrifuge to compare the protection provided to relaxed and straining subjects exposed to rapid onset G-profiles by the current mechanical valve system and the servo valve system The servo valve system proved superior to the mechanical system exhibiting an average 0.5G tolerance improvement when the subjects were in a relaxed state and an average 1.3G tolerance improvement when the subjects were in an M-1 straining state GRA

**N84-14688#** Naval Health Research Center, San Diego, Calif. MINICOMPUTER ADMINISTERED TASKS IN THE STUDY OF EFFECTS OF SUSTAINED WORK ON HUMAN PERFORMANCE Interim Report

D H RYMAN, P NAITOH, and C E ENGLUND Aug 1983 11 p (AD-A133870; NAVHLTHRSCHC-83-21) Avail NTIS HCA02/MFA01 CSCL 05J

The measurements of changes in human performance during laboratory studies of long-term (sustained) continuous work periods has been greatly facilitated with the introduction of computer administered and scored tasks This report documents six minicomputer administered tasks and their scoring programs which have been successfully used in the Sustained Operations research

program at the Naval Health Research Center. The minicomputer system used in these studies was a MINC-11 (Modular Instrumentation Computer from Digital Equipment Corporation) configured with A/D converter clock modules, two terminals and a printer. The tasks were selected for measurement sensitivity to sleep loss and fatigue. Four of these tasks involved measures of different types of reaction times. The TRAP tasks measured the response times of alternate pressing of two buttons, the Simple Reaction Time task recorded response times to a visual stimulus, the Alpha-Numeric Visual Vigilance task measured response latencies to correct and incorrect (disjunctive) visual signal detections, and the Four Choice Serial Reaction Time task measured reaction time involving correctness of choice to a visual stimulus in one of four areas on a terminal screen. Two other tasks prevented via computer were the Logical Reasoning Task, measuring correctness of complex information processing, and a Mood-Symptom-Fatigue and physiological state survey. The task programs were written in assembly language (MACRO-11), and the scoring-listing programs in Fortran IV. The programs have been run on MINC-11/03 and 11/23 computers, with two double-density disk drives. GRA

**N84-14689#** Air Force Inst of Tech, Wright-Patterson AFB, Ohio

**THE ABILITY TO PROCESS ABSTRACT INFORMATION M.S. Thesis**

M L MOROZE Sep 1983 91 p  
(AD-A133794, AFIT/CI/NR-83-51T) Avail NTIS HCA05/MFA01 CSCL 05H

The increasing use of technology in human-machine systems has brought about the need to determine how the introduction of sophisticated technology impacts the human's performance. How this technology interacts with the stress, workload, and information processing capacity of the individual is discussed. The technology discussed is based on the use of advanced flight displays, particularly the Head-Up Display, in the aircraft environment. A study was conducted using three different methods of displaying the flight information to the operator. It was found that, although all subjects could perform their flight tasks within pre-determined criteria, under a loading condition performance using a relatively abstract presentation style was significantly poorer than performance using a more traditional, relatively concrete presentation style. Author (GRA)

**N84-14690#** Battelle Columbus Labs, Ohio

**CARBON DIOXIDE SENSOR TECHNOLOGY Final Report**

A A BOIARSKI, P P BALOG, R H BARNES, H J BYKER, G B GAINES, and P S RIEGEL Apr 1983 85 p  
(Contract N61331-82-C-0024, S0394SL)  
(AD-A133688, AD-F200054, NCSC-CR-102-83) Avail NTIS HCA05/MFA01 CSCL 06K

The current state of the art of carbon dioxide sensing technology was examined in this task. It was found that no current system can meet the desired requirements. However, several approaches were identified which show promise. The overall summary of approach used to identify the promising sensor concepts is provided in this section along with the basic conclusions that were reached regarding available sensor techniques. Overall recommendations are also summarized below to provide NCSC guidance regarding their consideration of future efforts. Author (GRA)

**N84-14691#** Massachusetts Inst. of Tech., Cambridge Artificial Intelligence Lab

**PICKING UP AN OBJECT FROM A PILE OF OBJECTS**

K. IKEUCHI, B K P HORN, S NAGATA, T CALLAHAN, and O. FEINGOLD May 1983 29 p  
(Contract N00014-80-C-0505, N00014-77-C-0389)  
(AD-A133631, AI-M-726) Avail NTIS HCA03/MFA01 CSCL 06D

This paper describes a hand-eye system we developed to perform the bin-picking task. Two basic tools are employed: the photometric stereo method and the extended Gaussian image. The photometric stereo method generates the surface normal

distribution of a scene. The extended Gaussian image allows us to determine the attitude of the object based on the normal distribution. Visual analysis of an image consists of two stages. The first stage segments the image into regions and determines the target region. The photometric stereo system provides the surface normal distribution of the scene. The system segments the scene into isolated regions using the surface normal distribution rather than the brightness distribution. The second stage determines the object attitude and position by comparing the surface normal distribution with the extended-Gaussian-image. Fingers, with LED sensor, mounted on the PUMA arm can successfully pick an object from a pile based on the information from the vision part. Author (GRA)

**N84-14692#** Civil Aeromedical Inst., Oklahoma City, Okla. Civil Aeromedical Inst.

**AN ANALYSIS OF POTENTIAL PROTECTIVE BREATHING DEVICES INTENDED FOR USE BY AIRCRAFT PASSENGERS**

D DESTIEGUER and J T SALDIVAR May 1983 41 p  
(AD-A132648, FAA-AM-83-10) Avail NTIS HCA03/MFA01 CSCL 06K

This report presents the results of tests performed to examine concepts for the development of a passenger-type protective breathing device which would provide protection from toxic smoke/fumes produced during an in-flight fire and afford some protection during emergency evacuations. Data examined include expiratory PO<sub>2</sub>, PN<sub>2</sub>, PCO<sub>2</sub>, inspiratory PCO<sub>2</sub>, respiratory rates, and respiratory volume for the devices tested. GRA

**N84-14693#** North Carolina Agricultural and Technical State Univ., Greensboro Dept of Industrial Engineering

**COMPUTER AIDED TECHNIQUES FOR CREW STATION DESIGN, WORK-SPACE ORGANIZER-WORG, WORKSTATION LAYOUT GENERATOR-WOLAG**

B M PULAT Jun 1983 39 p  
(Contract N00014-81-C-0320, NR PROJ 196-168)  
(AD-A132981) Avail NTIS HCA03/MFA01 CSCL 05E

This study reports the development of two more modules in the Multi-Man-Machine Work Area Design and Evaluation System-MAWADES. The Work-space Organizer-WORG, and the Workstation Layout Generator-WOLAG. WORG is an interactive computerized model, which prepares the layout of several workstations within a work-space. The relative locations of the workstations are determined after link analysis (visual, voice and electronic communication) between stations. WOLAG is also a computerized interactive model, designed to prepare layouts at each station for sit-stand duty. Displays and controls are laid out sequentially on a panel based on system functions and operator tasks. The physical dimensions of the panel, along with panel sections and angles between sections, are determined after consideration of workspace geometry (anthropometric variables), the visual space (visual field, eye-head movements, etc.), and locational priority zones. Both modules collect evaluative measures on the designs generated. This data may be analyzed by a decision maker to choose the best design. GRA

**N84-15056#** Dornier-Werke GmbH, Friedrichshafen (West Germany) Avionics Dept

**THE LOCK-ON-BEFORE-LAUNCH WEAPON DELIVERY AND DISPLAY/CONTROL CONSIDERATION**

K. BOECKING In AGARD Advanced Concepts for Avionics/Weapon System Design, Develop and Integration 15 p  
Oct. 1983 refs  
Avail NTIS HC A21/MF A01

Investigations to provide basic test data to assess different methods of target acquisition and missile seeker aiming and lock-on are described. In addition, the pilot workload with different controls and displays was assessed and methods of reduction derived. Further different weapon information and weapon-video-display-systems and their advantages and disadvantages were investigated. The accuracy and speed of weapon aiming were especially evaluated. M G



**N84-15096#** Centre d'Essais en Vol, Bretigny-sur-Orge (France)

**THE MAN-MACHINE INTERFACE IN NEW GENERATION COMMERCIAL AIRCRAFT [L'INTERFACE HOMME - MACHINE DANS LES AVIONS COMMERCIAUX DE LA NOUVELLE GENERATION]**

R GALAN /in AGARD Flight Mech and System Design Lessons from Operational Experience 11 p Oct 1983 In FRENCH Avail NTIS HC A15/MF A01

The history of the man machine interface from the very beginning of aviation is reviewed and various trends for the last decade of this century are examined. A simple glance reveals that the style of relations between aircraft and their crews evolved in a profound way and that a spectacular leap has taken place over 80 years. Centralization, new generation instruments, cathode tubes, systems for flight management, display devices, and push button technology are explored. Transl by A R H

**N84-15102\*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

**PILOT HUMAN FACTORS IN STALL/SPIN ACCIDENTS OF SUPERSONIC FIGHTER AIRCRAFT**

S B ANDERSON, E K ENEVOLDSON (NASA Dryden Flight Research Facility), and L T NGUYEN (NASA Langley Research Center) /in AGARD Flight Mech and System Design Lessons from Operational Experience 10 p Oct 1983 refs Document previously announced as N83-26856 Avail NTIS HC A15/MF A01

A study has been made of pilot human factors related to stall/spin accidents of supersonic fighter aircraft. The military specifications for flight at high angles of attack are examined. Several pilot human factors problems related to stall/spin are discussed. These problems include (1) unsatisfactory nonvisual warning cues, (2) the inability of the pilot to quickly determine if the aircraft is spinning out of control, or to recognize the type of spin, (3) the inability of the pilot to decide on and implement the correct spin recovery technique, (4) the inability of the pilot to move, caused by high angular rotation, and (5) the tendency of pilots to wait too long in deciding to abandon the irrecoverable aircraft. Psycho-physiological phenomena influencing pilot's behavior in stall/spin situations include (1) channelization of sensor inputs, (2) limitations in precisely controlling several muscular inputs, (3) inaccurate judgment of elapsed time, and (4) disorientation of vestibulo-ocular inputs. Results are given of pilot responses to all these problems in the F14A, F16/AB, and F/A-18A aircraft. The use of departure spin resistance and automatic spin prevention systems incorporated on recent supersonic fighters are discussed. These systems should help to improve the stall/spin accident record with some compromise in maneuverability. Author

**N84-15799#** Oak Ridge National Lab, Tenn Instrumentation and Controls Div

**ROBOTICS-RELATED TECHNOLOGY IN THE NUCLEAR INDUSTRY**

W R HAMEL and H L MARTIN 1983 15 p refs Presented at the 27th Ann Intern Tech Symp on High Speed Photography, Videography and Photonics, San Diego, Calif, 23 Aug 1983 (Contract W-7405-ENG-26) (DE83-017131, CONF-830874-22) Avail NTIS HC A02

Similarities between teleoperators and robots are reviewed. Applications and development activities in teleoperated systems are summarized on a worldwide basis. Teleoperator developments are examined for outer space, under water, and other hazardous environments. The unification of a robot and a teleoperator system into an autonomous, flexible machine is envisioned as the goal of future telerobotic research. DOE

**N84-15800#** Office of Naval Research, London (England)

**ROBOT MANIPULATOR CONTROL**

J P BLACKBURN 7 Mar 1983 15 p refs (AD-A129365, R-1-83) Avail NTIS HC A02/MF A01 CSDL 05H

A synthetic approach for calculating the control of robot manipulators is given. The initial control problem is broken down into linear control and modelling problems. The approach allows derivation of numerous schemes (adaptive or not) of control proposed in the literature and suggests new schemes. It is shown that the problem of modeling is difficult but is less crucial if one can synthesize robust controls that are not sensitive to errors of modelling. GRA

**N84-15801#** Army Research Inst of Environmental Medicine, Natick, Mass

**EFFECTIVENESS OF TWO PORTABLE LIQUID-COOLED UNDERGARMENTS IN REDUCING HEAT STRESS**

G F FONSECA Apr 1983 22 p (Contract DA PROJ 3E1-62777-A-878) (AD-A133174, USARIEM-T-3/83) Avail NTIS HCA02/MFA01 CSDL 06Q

The auxiliary cooling provided by each of two portable liquid-cooled undergarments was directly measured on a life-sized sectional manikin. One undergarment (LCU 1) provided cooling over the torso area, the other (LCU 2) provided cooling over the torso and head areas. The liquid contained in both undergarments was cooled by circulating it through an ice-filled compartment (i.e., a heat exchanger). This manikin was dressed in a complete chemical protective (CW) suit in MOPP 4 configuration. Cooling rates (watts) were determined versus time for a completely wet (maximal sweating) skin condition during exposure to two hot environments. In a chamber environment of 45 deg C, the average torso cooling rate over the first hour for LCU 1 is about 94 watts which decreases to about 46 watts over the second hour of cooling, for LCU 2 the average torso and head cooling rates were 81 watts and 67 watts, over the first and second hours, respectively. Only about 20 watts of cooling was still being provided over the third hour of cooling by either portable liquid-cooled undergarment. GRA

**N84-15802#** Carnegie-Mellon Univ, Pittsburgh, Pa Robotics Inst

**A DISTRIBUTED CONTROL SYSTEM FOR THE CMU ROVER Progress Report**

A ELFES and S N TALUKDAR 27 Jan 1983 10 p Sponsored in part by Conselho Nacional de Desenvolvimento Cientifico e Tecnologico and Instituto Tecnologico de Aeronautica (Contract N00014-81-K-0503) (AD-A133201, AD-E000546) Avail NTIS HCA02/MFA01 CSDL 06D

This paper describes a distributed control structure developed for the CMU Rover, an advanced mobile robot equipped with a variety of sensors. Expert modules are used to control the operation of the sensors and actuators, interpret incoming data, build an internal model of the robot's environment, devise strategies to accomplish proposed tasks and execute these strategies. Each expert module is composed of a master process and a slave process, where the master process controls the scheduling and working of the slave process. Communication among expert modules occurs asynchronously with the aid of a blackboard. Information specific to the execution of a given task is provided through a control plan. The system is distributed over a network of processors. Operating system kernels local to each processor and an interprocess message communication mechanism ensure transparency of the underlying network structure. The various parts of the system are presented in this paper and future work to be performed is mentioned. Author (GRA)

**N84-15803\*#** Carnegie-Mellon Univ, Pittsburgh, Pa Robotics Inst

**THE STANFORD CART AND THE CMU ROVER**

H P MORAVEC 24 Feb 1983 40 p Sponsored in part by NASA and Defense Advanced Research Projects Agency and National Science Foundation  
(Contract N00014-81-K-0503)

(NASA-CR-174502, NAS 1 26 174502, AD-A133207, AD-E000546)  
Avail NTIS HCA03/MFA01 CSCL 06D

The Stanford Cart was a remotely controlled TV equipped mobile robot. A computer program was written which drove the Cart through cluttered spaces, gaining its knowledge of the world entirely from images broadcast by an onboard TV system. The CMU Rover is a more capable, and nearly operational, robot being built to develop and extend the Stanford work and to explore new directions. The Cart used several kinds of stereopsis to locate objects around it in 3D and to deduce its own motion. It planned an obstacle avoiding path to a desired destination on the basis of a model built with this information. The plan changed as the Cart perceived new obstacles on its journey. The system was reliable for short runs, but slow. The Cart moved one meter every 10 to 15 minutes, in lurches. After rolling a meter it stopped, took some pictures and thought about them for a long time. Then it planned a new path, executed a little of it, and paused again. It successfully drove the Cart through several 20 meter courses (each taking about 5 hours) complex enough to necessitate three or four avoiding swerves, it failed in other trials in revealing ways. The Rover system has been designed with maximum mechanical and control system flexibility to support a wide range of research in perception and control. It features an omnidirectional steering system, a dozen onboard processors for essential real time tasks, and a large remote computer to be helped by a high speed digitizing/data playback unit and a high performance array processor. Distributed high level control software similar in organization to the Hearsay II speech understanding system and the beginnings of a vision library are being readied. GRA

**N84-15804#** Carnegie-Mellon Univ, Pittsburgh, Pa Robotics Inst

**POPEYE: A GRAY-LEVEL VISION SYSTEM FOR ROBOTICS APPLICATIONS Interim Report**

R BRACHO, J F SCHLAG, and A C SANDERSON 4 May 1983 40 p

(Contract NSF ECS-79-23893)

(AD-A133298, CMU-RI-TR-83-6) Avail NTIS HCA03/MFA01 CSCL 09B

A gray-level image processing system has been constructed to provide capability for inspection, object orientation, object classification, and interactive control tasks in an inexpensive, stand-alone system with moderate processing speed. The POPEYE system offers a range of functions including algorithms for preprocessing, feature extraction, image modeling, focusing, automatic pan, tilt, and zoom, interactive communication with other devices, and convenient user interaction. The host processor is a Motorola 68000 processor with Multibus communication between principal modules, an image data bus for acquisition and storage and a pipeline bus for image preprocessing and programmable transform operations. The software structure provides hierarchical control over multiple I/O devices, file management of system storage, an image management package and a vector package. Performance of the system is evaluated using convolution filters, adaptive modeling, histogram modification, and connectivity analysis. Cellular logic operations, piecewise gradient segmentation, automatic focusing, and adaptive spatial filtering examples are described in detail. The system is being applied to a number of practical industrial applications. Author (GRA)

**N84-15805#** Carnegie-Mellon Univ, Pittsburgh, Pa Robotics Inst

**THE HUMAN SIDE OF ROBOTICS: RESULTS FROM A PROTOTYPE STUDY ON HOW WORKERS REACT TO A ROBOT Interim Report**

L ARGOTE, P S GOODMAN, and D SCHKADE May 1983 28 p

(AD-A133438, AD-E750844, CMU-RI-TR-83-11) Avail NTIS HCA03/MFA01 CSCL 06D

This study examines workers' reactions to the introduction of robots in a factory. The study focuses on understanding workers' psychological reactions to this new technology and to the manner in which it was introduced. Workers reported that both advantages (lower fatigue) and disadvantages (increased downtime) were associated with the introduction of the robot. Over time, workers' beliefs about robots became more complex and pessimistic. Production operators' jobs, as well as their interaction patterns with other production and support workers changed with the introduction of the robot. Consequences of these changes for increases in job stress are examined. A set of strategies for introducing robots in the factory is discussed. Author (GRA)

**N84-15806#** Carnegie-Mellon Univ, Pittsburgh, Pa Robotics Inst

**APPROPRIATE LENGTHS BETWEEN PHALANGES OF MULTIJOINTED FINGERS FOR STABLE GRASPING Interim Report**

T OKADA and T KANADE 22 Jul 1983 20 p

(AD-A133448, CMU-RI-TR-83-13) Avail NTIS HCA02/MFA01 CSCL 06D

An appropriate arrangement of finger joints is very important since the stability of grasping an object greatly depends on that arrangement. Multijointed fingers can grasp an object with many points of contact each of which is pressed against the object as if wrapping up that object. The amount of the wrapped up area and the form of the finger when an object is grasped are therefore important factors for determining the stability of grasping. The authors propose the wrapping factor to be used for the evaluation of the stability of grasping by using these factors. They consider twenty eight models for the finger having three joints, and perform a simulation of their ability to grasp various shapes stably. Based on the simulation results, an appropriate arrangement of lengths between phalanges for a multijointed finger is presented. GRA

**N84-15807#** Carnegie-Mellon Univ, Pittsburgh, Pa Robotics Inst

**IMPLEMENTATION OF AUTOMATIC FOCUSING ALGORITHMS FOR A COMPUTER VISION SYSTEM WITH CAMERA CONTROL Interim Report**

J F SCHLAG, A C SANDERSON, C P NEUMAN, and F C WIMBERLY 15 Aug 1983 90 p Sponsored in part by Navy and Westinghouse Electric Corp

(AD-A133492, CMU-RI-TR-83-14) Avail NTIS HCA05/MFA01 CSCL 09B

The POPEYE system is a gray level computer vision system developed for research and development. It provides a convenient environment for research by coupling a powerful microprocessor with a large base of support software. The particulars of the system's hardware configuration and software support are given after an explanation of the desires which motivated its fabrication. In addition to providing general computation and display capabilities, the system provides open loop manual or software control over the camera parameters of pan, tilt, focus, and zoom. This offers many advantages over fixed arrangements such as the ability to investigate focusing and elementary tracking algorithms. This work describes the implementation of several standard automatic focusing algorithms on the POPEYE system and provides experimental evaluation and comparison. This leaves the system with a valuable enhancement and provides a starting point for the implementation of a production focusing system. There are many possible uses for such a system, including robotic assembly and inspection tasks. One application is the development of industrial inspection algorithms for the Factory of the Future Project. Part



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of this project involved the inspection of fluorescent lamp mount assemblies. Algorithms for the automated inspection of the assemblies are described which represent the solutions to difficult inspection problems currently beyond the capabilities of commercial vision systems. Suggestions for the implementation of a production focusing system are given along with suggestions for possible hardware improvements to the POPEYE system. GRA

**N84-15808#** Human Performance Research, Inc., Goleta, Calif  
**COMPUTER BASED LANDING SIGNAL OFFICER CARRIER AIRCRAFT RECOVERY MODEL Final Report, Oct. 1977 - Jul. 1980**

M. E. MCCAULEY and G. J. BORDEN Sep 1983 70 p  
(Contract N61339-77-C-0110)  
(AD-A133507, HPR-101, NAVTRAEQUIPC-77-C-0110-1) Avail  
NTIS HCA04/MFA01 CSCL 09B

This report describes a two phase research effort to develop a two phase Landing Signal Officer (LSO) decision-making model to serve as a performance criterion in an automated training system. In the first of the two-phase development effort, analytic methods including observations, interviews, conferences and literature reviews were used to collect data concerning the LSO functions and decision-making processes during carrier aircraft recovery operations. GRA

**N84-15809#** University of Southern California, Redondo Beach Behavioral Technology Labs

**A PERFORMANCE-BASED TECHNIQUE FOR ASSESSING EQUIPMENT MAINTAINABILITY Final Report**

D. M. TOWNE, M. C. JOHNSON, and W. H. CORWIN Aug 1983 61 p  
(Contract N00014-80-C-0493, NR PROJ 196-165)

(AD-A133518, TR-102) Avail NTIS HCA04/MFA01 CSCL 15E

Previous research produced a computer-implemented model of corrective maintenance performance, based on a relatively simple maximum-productivity rule for selecting maintenance operations, and a relatively complex data base representing particular systems. The model has been expanded to recognize the impact of task-sequence context upon the actions necessary to accomplish tasks. Decisions at each stage of a simulated maintenance requirements now reflect the effects of previously performed work on the time and effort necessary to perform future tasks. Maintainability projections were generated for a digital infrared transmitter/receiver system, specially constructed to be configured in two functionally equivalent forms. Ten electronics technicians worked to identify and resolve eight inserted malfunctions each, using built-in indicators and standard test equipment. The overall projections of maintenance times compared well to the experimental data. A measure of design complexity is proposed for the evaluation of maintainability. This measure, mean number of indicators necessary to accomplish fault isolation, is sensitive to multiplicity of fault modes and to the extent to which fault symptoms are confounded at the maintainer interface. GRA

**N84-15810#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C.  
**LABORATORY ROBOTICS AT THE SAVANNAH RIVER LABORATORY**

G. M. DYCHES and S. D. BURKETT 1983 28 p refs Presented at the Eastern Anal Symp., New York, 16-18 Nov 1983 Submitted for publication

(Contract DE-AC09-76SR-00001)

(DE84-001760, DP-MS-83-43, CONF-831198-1) Avail NTIS HC A03/MF A01

Many analytical chemistry methods normally used at the Savannah River site require repetitive procedures and handling of radioactive and other hazardous solutions. Robotics is being investigated as method of reducing personnel fatigue and radiation exposure and also increasing product quality. Several applications of various commercially available robot systems are discussed involving cold (nonradioactive) and hot (radioactive) sample preparations and glovebox waste removal. Problems encountered in robot programming, parts fixturing, design of special robot hands and other support equipment, glovebox operation, and

operator-system interaction are discussed. A typical robot system cost analysis for one application is given. DOE

**N84-16051\*#** Kansas Univ., Lawrence Dept. of Electrical Engineering

**COMPUTER CONTROL OF A SEVEN DEGREE OF FREEDOM MANIPULATOR ARM**

J. STENSBY In Alabama Univ. Res. Rept. 1983 NASA/ASEE Summer Faculty Fellowship Program 33 p Dec 1983  
Avail NTIS HC A99/MF A01 CSCL 08H

An algorithm for the computer control of a seven degree of freedom manipulator arm, termed the Hawk Control Mode, is described. The algorithm is segmented into two distinct parts. One part controls the extension, azimuth, and elevation of the wrist joint. The second part controls the attitude of the terminal device. The two segments interact to achieve decoupling of wrist joint translation and terminal device rotation. M. G.

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### PLANETARY BIOLOGY

Includes exobiology, and extraterrestrial life

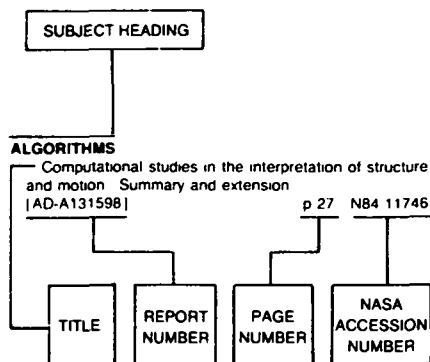
**A84-16939**

**PHOTOLYSIS OF URACIL AND URIDINE IN THE PRESENCE OF LUNAR SOIL [FOTOLIZ URATSILA I URIDINA V PRISUTSTVII LUNNOGO GRUNTA]**

E. A. KUZICHEVA and L. V. SMAGINA (Akademiia Nauk SSSR, Institut Tsitologii, Leningrad, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 273, no. 2, 1983, p. 501-505. In Russian. refs

A laboratory experiment was conducted to assess the influence of lunar soil (Luna-16 sample 1626) on the photochemical behavior of uracil and uridine. It is shown that lunar soil has a catalytic effect in the photolysis of these two substances, leading to the conclusion that the very low concentration of organic substances in lunar rocks and dust is determined, in part, by the decomposition of these substances under the effect of solar UV radiation and the catalytic effect of the regolith. The results lead to the assumption that purines, pyrimidines, and hydrocarbons synthesized in space or on the lunar surface have been subject to considerable photochemical transformations. B. J.

## Typical Subject Index Listing



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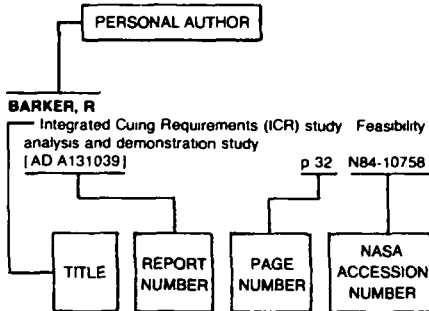
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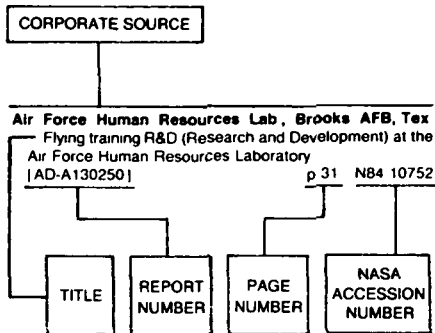
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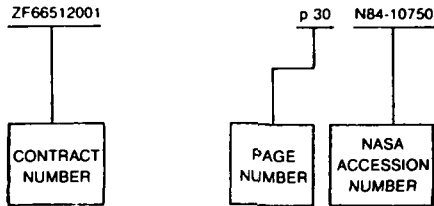
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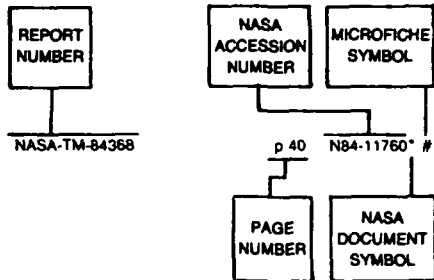


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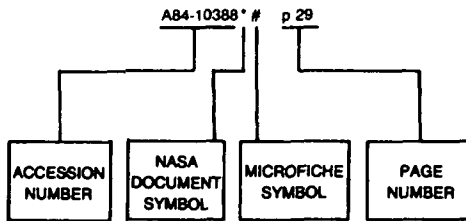
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